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SIDNEY F. GLASSMAN

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Herbaria Cited

A	Arnold Arboretum, Cambridge, Massachusetts
B	Botanisches Museum, Berlin-Dahlem
BH	L. H. Bailey Hortorium, Ithaca, New York
BM	British Museum, London
C	Botanical Museum and Herbarium, Copenhagen
CHI	University of Illinois at Chicago
COL	Instituto de Ciencias Naturales, Bogotá
F	Field Museum of Natural History, Chicago
FAIR	Fairchild Tropical Garden, Miami, Florida
FI	Herbarium Universitatis Florentinae, Firenze, Italy
G	Conservatoire et Jardin Botaniques, Genevé
GH	Gray Herbarium of Harvard University, Cambridge, Massachusetts
IPA	Instituto de Pesquisas Agronomicas, Dois Irmãos, Recife, Brazil
K	Royal Botanic Gardens, Kew, Great Britain
LE	Botanical Institute, Academy of Sciences of the USSR, Leningrad
M	Botanische Staatssamlung, München
MG	Museu Paraense Emilia Goeldi, Belém, Brazil
MO	Missouri Botanical Garden, St. Louis
NY	New York Botanical Garden, Bronx, New York
P	Museum National d'Histoire Naturelle, Paris
R	Museu Nacional, Rio de Janeiro
RB	Jardim Botanico, Rio de Janeiro
S	Naturhistoriska Rikmuseum, Stockholm
SP	Instituto de Botanica, São Paulo
U	Botanical Museum and Herbarium, Utrecht
UB	Universidade de Brasilia, D.F.

US United States National Museum, Washington, D.C.
USM Herbario San Marcos, Lima, Peru
VEN Instituto Botanico, Caracas

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Introduction

Syagrus was originally established as a genus by Martius in 1824, but no species were described until 1826. Much of the historical information pertaining to the taxonomy of *Syagrus* can be found in two other studies (Glassman, 1965, 1972b). All pertinent articles mentioned in these two papers, plus those published since, are listed under "Literature Cited" at the end of this monograph. I later transferred all species of the *Butia* unit to *Syagrus* (Glassman, 1970a) and all genera in the *Syagrus* unit to the genus *Syagrus* (Glassman, 1970b). After reconsideration, however, *Butia* was restored to full generic status (Glassman, 1979), and in the present paper *Syagrus* is again treated as a genus apart from other members of the *Syagrus* unit.

In his most recent classification of palms, H. E. Moore (1973) divided the family into 15 major groups. The Cocosoid group comprises three alliances and several units. In the *Cocos* alliance, the *Syagrus* unit is composed of *Syagrus, Arecastrum, Barbosa, Rhyticocos, Chrysallidosperma, Arikuryroba, Microcoelum,* and *Lytocaryum.* The above genera, plus members of the *Cocos* unit (*Cocos*) and *Jubaea* unit (*Jubaea, Jubaeopsis*), have been selected for revision in the present paper.

Other genera that I have studied in the *Cocos* alliance comprise the *Attalea* unit: *Attalea, Orbignya, Scheelea,* and *Maximiliana* (Glassman, 1977a,b,c; 1978a,c); revisions are in preparation. My goal is to monograph all 19 or 20 genera in the *Cocos* alliance, which also includes members of the *Parajubaea* unit (*Parajubaea*) and the *Allagoptera* unit (*Allagoptera* and *Polyandrococos*). Moore (1962) did a preliminary study of genus *Allagoptera.*

Systematic Considerations

Classification and identification of genera and species are based mainly on gross morphology, but other systematic considerations have been investigated. Of prime importance are the leaf anatomy studies, which have been useful in determining relationships between genera and species. This subject will be treated in detail under "Systematic Leaf Anatomy Studies" and "Taxonomic Treatment of Species"

The most comprehensive treatments of palm pollen (including several taxa in the *Cocos* alliance) were carried out by Thanikaimoni (1971) and Sowunmi (1972) in which they studied 800 species in 193 genera and 350 species in 120 genera, respectively. In my palynological survey of *Syagrus* and related genera, I investigated 56 different species and hybrids using a scanning electron microscope and a transmission electron microscope. All of the studies mentioned above showed that most of the species and genera in the *Cocos* alliance could not be distinguished from each other by pollen morphology. Therefore, further research on palynology has been discontinued because it seems to be a poor systematic tool for determining relationships between cocosoid palm taxa.

Relatively few research studies on the chemotaxonomy of palms have been published. The most significant papers have dealt with leaf flavonoids. Williams, Harborne, and Clifford (1973) surveyed the leaf flavonoid patterns of 125 species in 69 genera (including 13 cocosoid taxa), Glassman *et al.* (1981) studied leaf flavonoid and lipid patterns of 21 cocosoid palms, and in a continuation of the last study, Williams *et al.* (1983) looked at the flavonoids of 26 additional cocosoid taxa. Nine flavonoid compounds were extracted from these palms: negatively charged flavonoids, flavone C-glycosides, leucoanthocyanins, and glycosides of tricin, luteolin, quercitin, apigenin, isorhamnetin, and kaempferol. Because results of these studies are not entirely con-

clusive, they will be discussed in more detail under the taxonomic treatment of each species concerned. In the lipid research, six epicuticular waxes were extracted: alkanes, esters, ketones, aldehydes, and primary and secondary alcohols. Results are discussed under each species surveyed. Dr. J. Kagan, at the University of Illinois at Chicago, is currently researching several additional lipids that have been isolated but not identified in the cocosoid palms studied.

N. Uhl and H. E. Moore (1973) studied the structural features in palms related to protection of pollen and ovules. In *Syagrus* (e.g., *S. coronata*), they surmised that the thick, imbricate sepals and petals in pistillate flowers and the abundant sclerenchyma in both pistillate and staminate flowers probably serve as a deterrent or protection against herbivorous animals and phytophagous insects.

The fossil record of cocosoid palms is scanty. According to Moore (1973), fossil fruits have been reported from the Eocene of Florida, Peru, Ecuador, New Zealand, and India; and questionable specimens have been reported from the Upper Cretaceous of France. None of these, however, can be definitely attributed to modern genera in the *Syagrus* unit. Although there is no certain representation of the *Syagrus* unit in the fossil record, some of its cocosoid relatives have been in existence at least since the Eocene period.

Information from cytogenetics is scanty. Chromosome counts from the following cocosoid palms (n = 16, $2n$ = 32) were reported by Darlington and Wylie (1945): *Arecastrum romanzoffianum, Arikuryroba schizophylla, Butia bonneti, B. capitata, Cocos nucifera,* and *Jubaea spectabilis.* These taxa, plus *Rhyticocos amara* (n = 15), were verified by Read (1966), except that he reported n = 15 for *Arikuryroba schizophylla.* Almost nothing is known about other cytogenetic aspects such as polyploidy, aneuploidy, and chromosome aberrations; data from breeding experiments and population studies are apparently nonexistent.

Natural Distribution of *Syagrus* and Other Genera in *Cocos* Alliance

The genus *Syagrus* is found only in South America (Table 1). Of the 29 species that I recognize, 23 occur in Brazil, four in Paraguay, two each in Surinam, Guyana, Bolivia, Colombia, and Venezuela, and one each in Peru, Ecuador, and French Guiana. In Brazil, the greatest

concentrations occur in Bahia (ten) and Minas Gerais (nine). Other states where species of *Syagrus* occur are Goias, 6; Mato Grosso and Piaui, 5 each; Pará, 4; São Paulo and Rio de Janeiro, 3 each; Espirito Santo, Pernambuco, Ceará, and Maranhão, 2 each; and Paraná, Sergipe, Alagoas, Paraíba, Amazonas, and Amapá, 1 each. The majority of taxa in *Syagrus*, especially the trunkless ones, inhabit relatively dry or arid regions of Brazil and Paraguay (cerrados, 13; caatingas, 4; campos, 3; gneissic rock areas, 1; and quartzite rock areas, 1). The remaining species, mostly arborescent, grow in mesic or humid habitats (woodlands and coastal forests, 5; rain forests, 4; and rocky areas along streams, 1). According to Eiten (1972), cerrado, in the strict sense, is a semideciduous, xeromorphic, scrub type of vegetation dominant in central Brazil, and caatinga is a xeromorphic, thorn, scrub type of vegetation characteristic of Northeastern Brazil, which almost always contains cacti. (This should not be confused with caatinga in the Amazon region, which is a mesophytic type of vegetation growing on white sandy soils.) Both types of vegetation are complicated in that species composition changes from region to region. Campos are open, grassy areas with occasional woody plants, which are usually subject to fire and over-grazing.

Additional information on the distribution of *Syagrus* and other taxa in the *Syagrus* unit, *Cocos* unit, and *Jubaea* unit can be found in Tables 1 and 2, in the geographic distribution maps, and under taxonomic treatment of each species. Distribution of the *Butia* unit (Table 3) is also included here, but it has been treated taxonomically elsewhere (Glassman, 1979). These tables list specific information on localities and habitats but do not list the relative abundance of the more common species. Therefore, abundance is discussed below.

In certain parts of Brazil and other South American countries, palms in the *Syagrus* and *Butia* units make up a conspicuous part of the vegetation. They either occur in pure stands (e.g., *Syagrus coronata*), or dominance is shared by two species of palms (e.g., *S. oleracea* and *Arecastrum romanzoffianum*), or they frequently occur as scattered individuals (e.g., *S. flexuosa*) in communities where taxa of other angiosperm families are dominant.

The most abundant species, *S. coronata*, is especially common in caatingas throughout Bahia as a single dominant, or as a codominant with *S. vagans* in eastern Bahia. It has been estimated that approximately one-half billion trees of *S. coronata* grow in Bahia alone (Bondar,

Table 1. Natural Distribution of Genus *Syagrus*

Species	Country and State	Habitat
S. acaulis	Brazil: Piaui, Goias	cerrados
S. botryophora	Brazil: Bahia	coastal forest
S. campicola	Paraguay	campos
S. campylospatha	Paraguay	campos
S. cardenasii	Bolivia	woodlands
S. cocoides	Guyana; Brazil: Bahia, Ceará, Maranhão, Pará, Goias, Amapá, Piaui	wet forests, woodlands, cerrados
S. comosa	Brazil: Minas Gerais, Bahia, Piaui, Maranhão, Pará, Mato Grosso, Goias	cerrados, woodlands, caatingas
S. coronata	Brazil: Bahia, Minas Gerais, Pernambuco, Sergipe, Alagoas	caatingas, cerrados
S. duartei	Brazil: Minas Gerais	quartzite rock areas
S. flexuosa	Brazil: São Paulo, Minas Gerais, Bahia, Mato Grosso, Goias	cerrados
S. glaucescens	Brazil: Minas Gerais	cerrados
S. graminifolia	Brazil: Piaui, Mato Grosso, Goias	cerrados
S. harleyi	Brazil: Bahia	rocky areas along streams
S. inajai	Surinam; French Guiana; Brazil: Pará, Amazonas	rain forest
S. leptospatha	Brazil: Mato Grosso	campos and cerrados
S. lilliputiana	Paraguay	campos
S. loefgrenii	Brazil: São Paulo	cerrados
S. macrocarpa	Brazil: Minas Gerais, Rio de Janeiro	woodlands
S. mendanhensis	Brazil: Minas Gerais	cerrados
S. microphylla	Brazil: Bahia	caatingas
S. oleracea	Paraguay; Brazil: Paraná, São Paulo, Rio de Janeiro, Minas Gerais, Espirito Santo, Bahia, Pernambuco, Paraíba, Ceará	woodlands, cerrados

Table 1. Continued

Species	Country and State	Habitat
S. orinocensis	Colombia, Venezuela	rain forest, granitic outcrops
S. petraea	Bolivia; Brazil: Piaui, Pará, Mato Grosso, Goias	cerrados
S. pleioclada	Brazil: Minas Gerais	cerrados
S. ruschiana	Brazil: Espirito Santo, Minas Gerais	gneissic rock areas
S. sancona	Peru, Ecuador, Colombia, Venezuela	rain forest
S. stratincola	Surinam, Guyana	rain forest, granitic outcrops
S. vagans	Brazil: Bahia	caatingas
S. werdermannii	Brazil: Bahia	caatingas

1942b). This taxon is still very common in Brazil and will probably remain so for some time because there are no immediate plans to exploit the caatinga for agriculture, grazing, or settlements. In Pernambuco, between Neves and Garanhuns, *S. coronata* shares dominance with *S. oleracea* in cerrados. In some areas they hybridize, and the hybrids apparently backcross with either parent species. Some locally dominant palms in caatingas of central Bahia are *S. werdermannii* and *S. microphylla*. *Syagrus ruschiana* shares dominance with a columnar species of *Cereus* (Cactaceae) in certain restricted areas of black gneissic rock in Espirito Santo.

Cerrado vegetation has not yet been destroyed by man on a large scale. The following palms are dominant in limited areas: *S. glaucescens* in Minas Gerais, *S. loefgrenii* in São Paulo, and *Butia purpurascens* in Goias; *Butia paraguayensis* is a conspicuous part of the vegetation in São Paulo, Mato Grosso, and in parts of Paraguay and Argentina. In campos and pastures, *Butia archeri* frequently forms pure stands in scattered areas of Minas Gerais and Goias.

In woodlands, which have been decimated by agriculture, *Arecastrum romanzoffianum* is still one of the most abundant palms. In São Paulo,

Table 2. Natural Distribution of *Syagrus* Unit (Except Genus *Syagrus*), *Cocos* Unit, and *Jubaea* Unit

Species	Country and State	Habitat
Arecastrum romanzoffianum	Argentina; Paraguay; Uruguay; Bolivia; Brazil: Rio Grande do Sul, Santa Catarina, Paraná, São Paulo, Rio de Janeiro, Minas Gerais, Espirito Santo, Bahia, Goias, Mato Grosso	woodlands
Arikuryroba schizophylla	Brazil: Bahia, Pernambuco	coastal forest and along strand
Barbosa pseudococos	Brazil: São Paulo, Rio de Janeiro	woodlands
Chrysallidosperma smithii	Peru	rain forest
Lytocaryum hoehnei	Brazil: Sáo Paulo	open woodlands or forests
Microcoelum insigne	Brazil: Rio de Janeiro, Espirito Santo	campos or open fields
Microcoelum weddellianum	Brazil: Rio de Janeiro	campos or open fields
Rhyticocos amara	Central volcanic isles of Lesser Antilles: Martinique, Dominica, Guadeloupe, St. Lucia; Trinidad	dry coastal forests
Cocos nucifera	Pantropical in cultivation	mostly along the strand in sandy soils
Jubaea chilensis	Northern Chile	woodlands
Jubaeopsis caffra	South Africa	along river banks

Arecastrum is codominant with *S. oleracea* in a number of communities. In Paraguay, according to Michalowski (1958), *Arecastrum* is a solitary palm that occurs only as scattered individuals. Other woodland palms that comprise a noticeable element of the vegetation and frequently grow in pure stands are *Butia yatay,* in several areas of northern Argentina, and *B. eriospatha* and *B. capitata,* in Santa Catarina.

Table 3. Natural Distribution of *Butia* Unit

Species	Country and State	Habitat
B. archeri	Brazil: Minas Gerais, São Paulo, Goias	campos, pastures, or cerrados
B. arenicola	Paraguay; Brazil: Mato Grosso, Minas Gerais	campos and pastures
B. capitata	Brazil: Minas Gerais, Paraná, Santa Catarina, Rio Grande do Sul; Uruguay	woodlands, restingas and littoral campos on sandy or rocky soils
B. eriospatha	Brazil: Rio Grande do Sul, Santa Catarina	woodlands, campos
B. microspadix	Brazil: Paraná, Rio Grande do Sul	campos
B. paraguayensis	Paraguay; Argentina: Corrientes; Brazil: Santa Catarina, São Paulo, Mato Grosso	pastures
B. purpurascens	Paraguay; Brazil: Goias	cerrados
B. yatay	Argentina: Misiones, Santa Fe, Corrientes, Entre Rios; Uruguay; Paraguay	woodlands on sandy soil; campos on red acid soil

In tropical rain forests, which also have been subjected to much destruction by man, palm vegetation is apparently still dominated by *S. inajai* in parts of the Amazon region of Brazil, and *S. orinocensis* and *S. sancona* dominate in the Amazon regions of Colombia and Venezuela.

Much of the Atlantic coastal forest of Brazil has been cut and cleared for agriculture, but *Arikuryroba schizophylla* is still common in a number of localities in Bahia and Pernambuco along the coast.

Relationships Within *Cocos* Alliance

As previously noted, H. E. Moore (1973) divided the cocosoid group of palms into three parts: the *Elaeis* alliance, characterized by having pistillate flowers sunken in the rachillae; the *Bactris* alliance, which have plant parts with mostly scattered prickles; and the *Cocos* alliance,

differing from the other two by having pistillate flowers on the rachillae surface and by lacking prickles.

In the same paper, Moore classified the *Cocos* alliance into seven separate units, which I have keyed out below. Genera of each unit are in parentheses.

Since this manuscript has gone to press, an article by Dransfield and Uhl (1986) revising Moore's classification of Palms (1973) has been published. The new classification uses subfamilies, tribes, and subtribes instead of groups, alliances, and units. The genus *Syagrus* and allied genera are grouped in the subtribe *Butiinae,* one of five subtribes under tribe *Cocoeae.* The genera listed under this subtribe are *Butia, Jubaea, Jubaeopsis, Cocos, Syagrus, Lytocaryum, Parajubaea, Allagoptera,* and *Polyandrococos.* The following genera have been lumped under *Syagrus: Arecastrum, Arikuryroba, Barbosa, Chrysallidosperma,* and *Rhyticocos. Microcoelum* was reduced to synonymy under *Lytocaryum.* Because this article is preliminary to a forthcoming book by these authors, "Genera Palmarum, a Classification of Palms Based on the Work of H. E. Moore, Jr.," I cannot comment on the reclassification of the *Syagrus* unit until this book is published.

Morphological Key to Units in *Cocos* Alliance

1. Staminate flowers in separate staminate inflorescences, in androgynous inflorescences on the same rachillae in triads with pistillate flowers, and on separate rachillae within the same inflorescence .....
   .....*Attalea* unit (*Attalea, Scheelea, Orbignya,* and *Maximiliana*).
1. Staminate and pistillate flowers usually in same inflorescence, arranged in groups of 3, 1 pistillate accompanied by 2 staminate flowers on proximal part of rachilla, staminate flowers only on distal part of rachilla.
   2. Staminate flowers regularly with 6 stamens.
      3. Pistillate flowers globose; epidermal hairs of pinnae 3-4 inflated basal cells sunken in a circular depression; sterile bracts sulcate.....*Cocos* unit (*Cocos*).
      3. Pistillate flowers ovoid, rounded or pyramidal; epidermal hairs of pinnae with only one basal cell, or absent; sterile bracts smooth or sulcate.
         4. Sterile bracts smooth, becoming striate with age;

fruits 1-3 seeded; embryo pores usually located at or near middle of fruit..... *Butia* unit (*Butia*).

4. Sterile bracts sulcate; fruits usually 1-seeded, occasionally 2-seeded; embryo pores located near base of fruit.
   5. Inflorescences unbranched; flowers densely distributed around rachis..... ..... *Allagoptera* unit (some species of *Allagoptera*).
   5. Inflorescences usually branched, when simple; flowers loosely distributed on two sides of rachis .... *Syagrus* unit (genera keyed out below).

2. Staminate flowers usually with more than 6 stamens (7-120).
   6. Inflorescences unbranched; stamens 7-12 and 90-120..... ..... *Allagoptera* unit (*Allagoptera, Polyandrococos*).
   6. Inflorescences branched; stamens 8-30.
      7. Sterile bracts smooth, becoming striate with age; stamens 8-16 and 15-30; embryo pores located at or near middle of fruit..... *Jubaea* unit (*Jubaea, Jubaeopsis*).
      7. Sterile bracts sulcate; stamens 15; embryo pores located near base of fruit..... *Parajubaea* unit (*Parajubaea*).

Of the nine members in *Syagrus* unit keyed out below, only *Lytocaryum* and the two species of *Microcoelum* seem to be closely related, both morphologically and anatomically. *Arikuryroba, Chrysallidosperma,* and *Arecastrum* appear to be allied to certain species of *Syagrus* (i.e., *S. ruschiana, S. inajai,* and *S. comosa,* respectively). The other two genera, *Barbosa* and *Rhyticocos,* probably have no close relatives.

Morphological Key to Taxa in *Syagrus* Unit

1. Mesocarp splitting into 3 sections at maturity, endocarp thin and papery; pinnae silvery glaucous or brownish pubescent; sterile bracts brownish or blackish tomentose.
   2. Pinnae from mid-section about 40 cm long and 2.0 cm wide, brownish pubescent; staminate and pistillate flowers 6-8 mm long; endosperm of seed ruminate .... *Lytocaryum hoehnei.*
   2. Pinnae from mid-section 21-23 cm long and 0.5-1.5 cm wide, silvery glaucous; staminate and pistillate flowers 2.5-5.0 mm long; endosperm of seed homogeneous.
      3. Pinnae from mid-section 1.0-1.5 cm wide; sterile bracts

blackish-brown tomentose; rachillae about 20 cm long; perianth of pistillate flowers not nerved .... *Microcoelum insigne.*

3. Pinnae from mid-section 0.5-1.0 cm wide; sterile bracts brownish tomentose; rachillae 8-13 cm long; perianth of pistillate flowers distinctly nerved .... *Microcoelum weddellianum.*

1. Mesocarp not splitting into sections at maturity, endocarp usually thick and woody; pinnae not silvery glaucous and rarely brownish pubescent; sterile bracts sometimes brownish but never blackish pubescent.
   4. Endosperm of seed ruminate.
      5. Pistillate flowers ovoid, round or oblong in shape.
         6. Pistillate flowers with obtuse tips, 25-32 mm long; pinnae from mid-section in clusters of 2-4; petiole margins not spiny ..... *Barbosa pseudococos.*
         6. Pistillate flowers with round or acute tips, 5-7 mm long; pinnae from mid-section regularly arranged; petiole margins densely spiny for most of their length ..... *Arikuryroba schizophylla.*
      5. Pistillate flowers pyramidal in shape.
         7. Endocarp cavity triangular in cross section; seeds 3-lobed with truncate ends; perianth of pistillate flowers not distinctly nerved; ovary more or less glabrous ..... *Chrysallidosperma smithii.*
         7. Endocarp cavity more or less round in cross section; seeds ovoid with pointed or rounded ends; perianth of pistillate flowers distinctly nerved; ovary tomentose ..... *Rhyticocos amara.*
   4. Endosperm of seed homogeneous.
      8. Endocarp cavity very irregular in shape; seed gibbous-uncinate, conforming to shape of cavity .... *Arecastrum romanzoffianum.*
      8. Endocarp cavity usually rounded or slightly angular in shape; seeds mostly ovoid or round ..... *Syagrus.*

In previous articles (Glassman, 1970a, 1970b), I included all genera listed in the *Syagrus* and *Butia* units under the genus *Syagrus, sensu lato,* largely on the basis of the following: *Chrysallidosperma smithii* and *Syagrus inajai* are the only taxa in the *Syagrus* unit with triangular

fruit cavities and three-lobed seeds. The major difference is seeds with ruminate endosperm in *Chrysallidosperma. Arikuryroba schizophylla* has toothed petiole margins and ruminate endosperm in its seeds, but it seems to be closely related to five species of *Syagrus* that have an unusual leaf anatomy pattern; at least one of these species (*S. vagans*) has toothed petiole margins. *Arecastrum romanzoffianum* differs from other species of *Syagrus* in the gibbous-uncinate seed and the irregular endocarp cavity; otherwise, it seems to be related to certain species of *Syagrus* (e.g., *S. comosa* and *S. botryophora*). In the present paper, I recognize all genera listed by H. E. Moore (1973) under the *Syagrus* unit as distinct entities. The current evidence for "lumping" all genera in the *Syagrus* unit under *Syagrus, sensu lato,* is not overwhelming.

Five of the eight genera in the *Syagrus* unit (*Arikuryroba, Barbosa, Chrysallidosperma, Lytocaryum,* and *Rhyticocos*) have ruminate endosperm. This characteristic is one of the most important for distinguishing these genera from *Syagrus;* however, none of the above genera seem to be closely related to each other. Apparently, this situation is a case of parallel evolution where the same characteristic, ruminate endosperm, developed independently in five different genera in the same group of palms.

The Genus *Syagrus*

All published names pertaining to *Syagrus* as a genus are included here. As discussed previously, the genus *Syagrus* cannot be divided satisfactorily into natural, clear-cut subgeneric categories. Therefore, all subgeneric and sectional names previously described by myself and others have been reduced to synonymy. Nevertheless, apparent relationships between species or groups of species are discussed throughout the text without giving formal rank names to these taxa. A description of the genus is followed by a morphological key to all 29 species of *Syagrus*. Listing of taxa is based on the discussion under "Intergeneric Relationships" and is numbered accordingly. The first 17 species are arranged in related groups, for the most part. The next seven are listed in groups of possible, but uncertain, relationships. The last five taxa are apparently without close alliances in *Syagrus*. Each species (as well as its synonyms) includes author, original place and date of publication, and, frequently, other pertinent articles. Complete citations of all references mentioned in the text are listed under "Literature Cited" at the end. The type of each taxon is listed, followed by a description of salient characteristics and the specimens examined by the author. Holotypes, isotypes, and lectotypes are specifically listed as such; however, when the status of the type of a species is uncertain, it is merely referred to as "type." For each specimen cited, the collector's name and collecting number are followed by an abbreviation of the herbarium where the collection is deposited (cf. Holmgren *et al.*, 1981). Flowering periods, vernacular names, and geographic and ecologic distribution for each species are also recorded. The treatment concludes with a discussion of apparent relationships and other information pertinent to that particular species, such as selection of types, range of variation in different habitats, and limited information on economic importance. Illustrations and dis-

tribution maps included in this paper and those published elsewhere are mentioned under each species.

Besides the 29 species of *Syagrus*, five hybrids involving taxa in *Syagrus* and related genera are also treated in a manner similar to that outlined above. Following this is a list and discussion of "Doubtful and Uncertain Species" and a list of "Excluded Species."

Intergeneric Relationships

Glassman (1970b) divided *Syagrus* into two subgenera and 13 sections and erected a phylogenetic tree of all species. That treatment included genera now considered to be part of the *Syagrus* unit and *Butia* unit. After completing my leaf anatomy survey (Glassman, 1972a), I realized that these subdivisions are not entirely natural; therefore, a reevaluation of relationships within *Syagrus* and between allied genera became necessary.

In Glassman 1970b, *Syagrus* was split up as follows: species with pinnae from the mid-section of the leaf arranged in clusters were grouped under subgenus *Syagrus*; those with middle pinnae regularly arranged along the rachis were grouped under subgenus *Syagropsis*. Apparently, all members within each subgenus are not necessarily closely related to one another. For example, *S. microphylla* has middle pinnae in clusters of 2-3, yet it may be more closely allied to a group of species with an unusual leaf anatomy pattern (*S. vagans*, *S. harleyi*, *S. werdermannii*, and *S. ruschiana*), which has regularly arranged pinnae.

After removing the *Butia* unit and other genera in the *Syagrus* unit from *Syagrus*, only about 16 of the 29 members in genus *Syagrus* could be grouped into distinct sections. The largest section would contain four taxa and the other sections, two species each. The remaining members apparently have no close relatives; hence, the erection of a separate section for each species would probably be required. Several taxa are incompletely known and, therefore, difficult to categorize properly.

Because I am unable to find a satisfactory or logical way to divide *Syagrus* into subgenera or sections based on our present knowledge, such infrageneric taxa will not be recognized in this paper. In the following discussion, however, I have placed species that appear to have the closest affinities together in the same group. Of the more

specialized taxa, the only members of the genus with unbranched inflorescences are *S. campicola, S. leptospatha, S. petraea,* and *S. acaulis.* The first two are more closely related to each other and have leaf anatomy patterns similar to species of *Butia,* whereas the patterns of the last two resemble most species of *Syagrus.* Other specialized taxa (inflorescences with reduced number of rachillae) are *S. lilliputiana* and *S. graminifolia.* These taxa are similar in leaf anatomy patterns to *S. campicola* and *S. leptospatha,* yet they are distinct from them morphologically. Perhaps the largest group of species that are closely allied morphologically and anatomically are *S. vagans, S. harleyi, S. werdermannii,* and *S. ruschiana.* The following species groups also seem to be more or less closely related morphologically and anatomically: *S. loefgrenii, S. cardenasii,* and *S. cocoides;* and *S. glaucescens* and *S. duartei.* Apparently, *S. cocoides* is also allied to *S. orinocensis* but not as closely as the other two taxa listed above.

The remaining species of *Syagrus* seem to represent separate, isolated sections; however, some of these show possible relationships to each other and to other genera in the *Syagrus* unit. *Syagrus botryophora* has pistillate flowers that resemble those of *S. comosa* and *Arecastrum romanzoffianum,* and it has a leaf anatomy pattern similar to those of *Cocos nucifera* and *Rhyticocos amara.* However, it probably has no close evolutionary ties with these taxa. Both *S. mendanhensis* and *S. pleioclada* have similar leaf anatomy patterns and are endemic in adjacent areas of Minas Gerais, but important morphological differences preclude their placement in the same section. As previously mentioned, *S. microphylla* seems to have anatomical links with four other species of *Syagrus,* but it probably has no close relatives because of its distinct morphological characteristics. Another apparently isolated taxon is *S. campylospatha,* which has anatomical ties to members of the genus *Butia. S. comosa* appears to have a closer relationship to *A. romanzoffianum* than to other species of *Syagrus,* in spite of differences in fruit and seed. The specialized anatomical and morphological features of *S. sancona,* which has no apparent close relatives, justify its placement in a separate section. The similarity of the large pyramidal pistillate flowers of *S. flexuosa, S. macrocarpa,* and *S. oleracea* may indicate close ties, but their dissimilar leaf anatomy patterns probably preclude their consideration as a natural section. Of the remaining species being discussed, *S. stratincola* and *S. coronata* appear to be without close relatives, and *S. inajai* seems to be more closely allied to *Chrysalli-*

dosperma smithii than to members of *Syagrus*, in spite of basic endosperm differences.

Syagrus appears to be in the process of fragmenting or evolving into other genera. There seem to be large morphological and anatomical gaps between species within the genus because slightly more than one-half of the taxa appear to be closely related to each other. Perhaps *Syagrus* arrived at this stage of evolution by gradual extinction of a number of interlinking species over a long period of time and the surviving species became more clearly differentiated. This theory is borne out by the fact that several genera in the *Syagrus* unit, e.g., *Arikuryroba, Arecastrum,* and *Chrysallidosperma,* apparently exhibit morphological or anatomical links to certain species in *Syagrus*, yet they have enough important differences for generic segregation.

Syagrus and other allied genera probably have been evolving since the Eocene period (about 50 million years ago). As previously noted, Eocene cocosoid fossil fruits have been reported from several localities. Perhaps the more closely related species have evolved in a more recent geological period, whereas the well differentiated, less closely related taxa may have existed a much longer time. Unfortunately, the fossil record is insufficient to document more accurately the time some of these evolutionary events could have taken place.

Taxonomic Treatment

SYAGRUS Mart., Palm, fam. 18. 1824; COCOS sect. *Syagrus* (Mart.) Drude *in* Martius, Fl. Brasil. 3:401. 1881; COCOS subgen. *Syagrus* (Mart.) Drude *in* Engler & Prantl Nat. Pflanzenfam. II. 3:81. 1887; SYAGRUS sect. *Orthosyagrus* Burret, Notizbl. Bot. Gart. Berlin-Dahlem 13:679. 1937; SYAGRUS subgen. *Syagrus* Glassman, Fieldiana Bot. 32:228. 1970; sect. *Syagrus* Glassman, Fieldiana Bot. 32:229. 1970. (excluding *Rhyticocos amara*). Type species: *Syagrus cocoides* Mart., Hist. Nat. Palm. 2:130. 1826.

SYAGRUS sect. *Inajai* Glassman, Fieldiana Bot. 32:230. 1970 (excluding *Chrysallidosperma smithii*). Type species: *Syagrus inajai* (Spruce) Becc. COCOS sect. *Diplothemiopsis* Drude *in* Martius, Fl. Brasil. 3:404. 1881.

SYAGRUS sect. *Diplothemiopsis* (Drude) Glassman, Fieldiana Bot. 32:234. 1970. Type species: *Syagrus petraea* (Mart.) Becc.

SYAGRUS subgen. *Syagropsis* Glassman, Fieldiana Bot. 32:234. 1970;

and sect. *Syagropsis* Glassman, *ibid.* 237. 1970. Type species: *Syagrus botryophora* (Mart.) Mart.

SYAGRUS sect. *Campylospatha* Glassman, Fieldiana Bot. 32:228. 1970. Type species: *Syagrus campylospatha* (Barb. Rodr.) Becc.

SYAGRUS sect. *Coronata* Glassman, Fieldiana Bot. 32:230. 1970. Type species: *S. coronata* (Mart.) Becc.

SYAGRUS sect. *Sancona* Glassman, *ibid.* 231. 1970. Type species: *S. sancona* H. Karsten.

SYAGRUS sect. *Oleracea* Glassman, *ibid.* 233. 1970. Type species: *S. oleracea* (Mart.) Becc.

SYAGRUS sect. *Graminifolia* Glassman, *ibid.* 237. 1970. (excluding *S. archeri* and *S. hatschbachii*). Type species: *S. graminifolia* (Drude) Becc.

Trees (in 14 species) 2 m tall and 6 cm in diameter (*S. flexuosa*) to 36 m tall and 30-35 cm in diameter (*S. oleracea* and *S. sancona*), trunks usually single, occasionally caespitose (*S. flexuosa* and *S. ruschiana*), at first with prominent scars caused by abscission of leaves, later becoming obscured through weathering. Leaves usually without definite pattern of placement around trunk, rarely arranged in five spiral rows (*S. coronata*); without emergent stem (in 15 species) but with subterranean stem and occasionally with short aerial trunk (*S. loefgrenii*); leaves borne at apex of stem in a dense crown or cluster, with youngest ones in center; distinction between sheathing leaf base and petiole frequently obscure, leaf sheath 4 cm long (*S. leptospatha*) to 95 cm long (*S. oleracea*) and 20-25 cm or more wide, margins usually consisting of mass of relatively fine or coarse interwoven fibers, rarely (*S. coronata*) with additional rows of long, broad, flat spinelike fibers; petiole 2-4 cm (*S. lilliputiana* and *S. campicola*) to 150 cm long (*S. stratincola*), 0.5-1.5 cm wide for most trunkless species to 5-7 cm wide in some arborescent taxa, surfaces glaucous or tomentose, especially when young, margins usually with short, narrow, soft, or stiff fibers for most of petiole length, distal portion gradually losing fibers with age, rarely sparsely dentate on proximal third of petiole (*S. vagans*), or rarely with long broad, flat spine-like fibers for most of length (*S. coronata*); leaf rachis 25 cm long (*S. lilliputiana*) to 313 cm long (*S. inajai*), surface often glaucous or pubescent, with whitish or brownish ramenta, sometimes tomentose (*S. flexuosa*), frequently becoming green or glabrous with age; blades pinnately compound, pinnae reduplicate in vernation (inverted V-shaped in cross section), 9-10 (*S. leptospatha*

and *S. lilliputiana*) to 163 (*S. sancona*) in number on each side of rachis, uppermost and lowermost series usually much shorter and narrower than middle series of pinnae which are 10 cm long (*S. microphylla* and *S. loefgrenii*) to 88-100 cm long (*S. oleracea* and *S. cocoides*) and 0.3-0.4 cm wide (*S. campicola* and *S. leptospatha*) to 4.5-4.7 cm wide (*S. sancona*), regularly (singly) arranged or in clusters of 2-5, regularly or irregularly spaced, intervals between pinnae or clusters 0.5-10 cm, with acute, acuminate or obtuse and symmetrical or asymmetrical tips, surfaces glaucous or pubescent with whitish or brownish ramenta, especially along veins, frequently becoming green or glabrous with age, rarely appressed whitish-brown pubescent adaxially (*S. campylospatha*), cross veinlets frequently prominent adaxially (*S. cocoides, S. comosa*). Inflorescences usually 3-4 in number, located in the axils of older leaf bases, each consisting of a peduncle and a rachis usually branched and bearing many flowers, inflorescence surrounded by a basal prophyll, which is usually concealed by a leaf sheath and overlaps a much larger sterile bract, which encloses whole inflorescence in bud and at maturity splits longitudinally along a mid-ventral line exposing a small part of the peduncle and eventually most of the rachis and its flowers; expanded part of sterile bract from 4 cm long and 0.5 cm wide (*S. leptospatha*) to 100-110 cm long (*S. stratincola* and *S. sancona*) and 33 cm wide (*S. botryophora*), usually sulcate, mostly woody-fibrous or woody and brittle, rarely papery in texture (*S. leptospatha*), frequently glaucous or brownish pubescent, becoming green or glabrous with age, rarely with small, conspicuous orange punctate glands (*S. microphylla*); inflorescences usually with both staminate and pistillate flowers, rarely with mostly fertile staminate flowers and some abortive pistillate flowers (in some specimens of *S. sancona* and *S. inajai*); rachis usually branched, less commonly simple or unbranched (*S. acaulis, S. campicola, S. leptospatha, S. petraea*), 5 cm long (*S. lilliputiana*) to 98 cm long (*S. ruschiana*), terminal portion of rachis usually enclosed in the sterile bract and shorter, rarely longer and extending beyond tip of sterile bract (*S. leptospatha*), rachillae 2-7 (*S. graminifolia* and *S. lilliputiana*) to 138 in number (*S. sancona*), frequently with scattered patches of whitish or brownish ramenta, especially in the axils, becoming glabrous with age, usually scrobiculate, rarely gnarled and twisted (*S. pleioclada*), generally longer near base and gradually becoming shorter near the tip of rachis, lower ones 1 cm long (*S. pleioclada*) to 55-58 cm long (*S. ruschiana*); peduncle 10 cm long in several species to 107 cm long

(*S. vagans*). Flowers in groups of three, one central pistillate and two lateral staminate on proximal half of rachilla, staminate flowers only on distal half; after anthesis pistillate flowers usually persist on rachillae much longer than staminate flowers, eventually both kinds absciss (except those involved in fruit formation) leaving individual scars; pistillate flower scars more or less round, up to 1 cm in diameter (*S. macrocarpa*), surrounded by three short, broad overlapping bracts; staminate flower scars small, long and narrow, surrounded by three bracts of similar size and shape; staminate flowers generally one to several mm longer on proximal half of each rachilla than on distal half, usually sessile, often narrowed basally into a pseudopedicel up to 4 mm long, sometimes with pedicel (*S. flexuosa* and *S. sancona*), more or less flattened, mostly oval in shape, 2-6 mm wide and 4 mm long (*S. leptospatha*) to 20-22 mm long (*S. duartei* and *S. oleracea*) on proximal part of rachilla, 3-15 mm long on distal part, sepals 3, much shorter than petals (1-5 mm long), triangular, with free, acuminate or acute tips, sometimes imbricate, with fused bases, petals 3, separate, relatively thin fibrous, sometimes fleshy (*S. botryophora* and *S. comosa*), valvate, lanceolate or ovate, tips usually acute, variously pubescent, sometimes with patches of white ramenta (*S. stratincola*), frequently with reddish or orangish glandular dots; stamens 6, separate, included in corolla, anthers dorsifixed, 1.5 mm long (*S. leptospatha*) to 7-9 mm long (*S. oleracea*), filaments inserted on receptacle, pistillode usually absent; pistillate flowers usually sessile, at anthesis more or less pyramidal, rounded, ovoid or oblong in shape, 4 mm long and 3 mm in diameter (*S. ruschiana*), to 35 mm long and 19 mm in diameter (*S. macrocarpa*), sepals and petals 3 each, somewhat fleshy, usually similar in size and shape, usually imbricate, with acute tips, rarely conspicuously wrinkled (*S. sancona*); sepals occasionally shorter than petals, rarely with obtuse tips (*S. sancona*), occasionally nerved (*S. ruschiana* and *S. werdermannii*), with patches of whitish ramenta, sometimes with orangish or reddish glandular dots (*S. sancona*); petals rarely shorter and darker than sepals (*S. sancona*), seldom valvate (*S. flexuosa*); pistil with three united, uniovulate carpels, ovary superior, usually very short (about 1 mm), glabrous or sometimes tomentose, style single, several times longer than ovary and inflated, usually included in corolla, stigma indistinctly three lobed;, staminodes inconspicuous or apparently absent; pubescent and glaucous sterile bracts gradually become glabrous and greenish or brownish, and rachillae usually

become slightly thicker during fruit development. Fruits 1.2-1.4 cm long (*S. lilliputiana* and *S. leptospatha*) to 9.0 cm long (*S. macrocarpa*) and 0.7-4.5 cm in diameter, usually ovoid, occasionally ellipsoid (*S. flexuosa, S. vagans*), sometimes rounded (*S. stratincola* and *S. leptospatha*), rarely turbinate (*S. duartei*), beak absent or up to 8 mm long, persistent perianth 0.5-2.0 cm high, staminodial ring connate, usually a very short cupule, occasionally prominent (*S. comosa*), epicarp (exocarp) more or less smooth, occasionally striate (*S. stratincola* and *S. werdermannii*), mesocarp usually green and fibrous, frequently orange and fleshy at maturity, endocarp usually woody or bony, 1-8 mm thick along sides, 3-13 mm thick at extremities, locules usually one, trivittate (with 3 longitudinal stripes representing carpels) within, more or less circular in cross section, rarely asymmetrical or triangular (*S. inajai*), locules occasionally two (*S. campicola, S. graminifolia*), semicircular or triangular in cross section. Seeds usually conforming to shape of locules, 0.6-6.0 cm long, 0.6-2.4 cm in diameter, endosperm homogeneous.

Key to Species of *Syagrus* Based on Morphology

1. Pinnae from mid-section of leaf usually regularly arranged along rachis.
   2. Plants usually lacking an emergent stem, occasionally stem short, about 1 m high or less; pinnae from mid-section 0.5-2.5 cm wide.
      3. Inflorescence usually unbranched.
         4. Inflorescence as long or longer than sterile bract.
            5. Sterile bract woody, 17-19 cm long; peduncle 7.5-9.5 cm long; rachis 10 cm long; pinnae with asymmetrical tips..... 1. *S. campicola.*
            5. Sterile bract papery, 4-5 cm long; peduncle 13 cm long; rachis 3.0-5.5 cm long; pinnae with symmetrical tips..... 2. *S. leptospatha.*
         4. Inflorescence shorter than sterile bract.
            6. Pistillate flowers ovoid or rounded at anthesis, 6-7 mm long; pinnae 20-25 on each side, more or less equally distributed along rachis .....3. *S. acaulis.*

6. Pistillate flowers pyramidal at anthesis, 10-14 mm long; pinnae 11-13 on each side, usually unequally distributed along rachis ..... 4. *S. petraea*.

3. Inflorescence with 2-many rachillae.
   7. Pistillate flowers pyramidal at anthesis; inflorescence with 2-7 rachillae.
      8. Inflorescence usually unbranched, occasionally with 2 rachillae; staminate flowers 12-20 mm long on proximal half and 10-14 mm long on distal half of rachilla; pinnae usually unequally distributed along rachis .... 4. *S. petraea*.
      8. Inflorescence always branched, with 2-7 rachillae; staminate flowers 8-10 mm long on proximal half, 4-7 mm long on distal half of rachilla; pinnae more or less equally distributed along rachis.
         9. About 10 pinnae on each side of rachis; sterile bracts 5.0-6.5 cm long; pistillate flowers 6-7 mm long; sepals distinctly nerved; ovary tomentose..... ..... 5. *S. lilliputiana*.
         9. About 25 pinnae on each side of rachis; sterile bracts 20-30 cm long; pistillate flowers 9-13 mm long; sepals more or less smooth; ovary glabrous .... 6. *S. graminifolia*.
   7. Pistillate flowers ovoid or rounded at anthesis; inflorescence with 11-45 rachillae.
      10. Petiole margins sparsely dentate on proximal third, smooth or fibrous on distal two-thirds; expanded part of sterile bract 85-106 cm long and 8 cm wide; peduncle 107 cm long; branched part of inflorescence 55-60 cm long; rachillae 42-45 in number; calyx and corolla of pistillate flowers nerved on distal half, smooth on proximal half.....7. *S. vagans*.
      10. Petiole margins smooth or fibrous throughout; expanded part of sterile bract 34-51 cm long and 2-3 cm wide; peduncle 62-72 cm long; branched part of inflorescence 17-40 cm long; rachillae 11-22 in number; calyx and corolla of pistillate flowers nerved throughout.

11. Leaf rachis 93-136 cm long; middle series pinnae 2.2-2.5 cm wide, dark green adaxially, glaucous abaxially; sterile bracts usually glabrous at anthesis; branched part of inflorescence about 17 cm long; rachillae 17-22 in number, each 6-12 cm long; mature fruits orange; 1-2 seeded ..... 8. *S. harleyi.*

11. Leaf rachis 50-59 cm long; middle series pinnae 1.0-1.8 cm wide, glaucous on both surfaces; sterile bracts tomentose at anthesis; branched part of inflorescence 30-40 cm long; rachillae 11-14 in number, each 22-25 cm long; mature fruits greenish, 1-seeded..... ..... 9. *S. werdermannii.*

2. Plants arborescent, 4-18 m tall; pinnae from mid-section 2.8-3.5 cm wide.

12. Leaf with 76-80 pinnae on each side; sterile bracts 60-66 cm long, 25-33 cm wide; branched part of inflorescence 46-50 cm long; petals of staminate flowers without reddish glandular dots; perianth of pistillate flowers not distinctly nerved; fruit 4.0-4.5 cm long .. .. 23. *S. botryophora.*

12. Leaf with 50-54 pinnae on each side; sterile bracts 100-110 cm long and 5-6 cm wide; branched part of inflorescence 90-98 cm long; petals of staminate flowers with reddish glandular dots; perianth of pistillate flowers distinctly nerved; fruit 2.5 cm long .... 10. *S. ruschiana.*

1. Pinnae from mid-section of leaf in distinct clusters of 2-5 along rachis.

13. Pistillate flowers ovoid or rounded at anthesis.

14. Plants without emergent stem; pinnae about 1 cm wide, intervals of 6-10 cm between clusters; branched part of inflorescence 5-9 cm long; rachillae gnarled and twisted, 1.0-3.5 cm long; perianth of pistillate flowers smooth..... 18. *S. pleioclada.*

14. Trees 5-20 m tall; pinnae 3.0-4.5 cm wide, intervals of about 2-4 cm between clusters; branched part of inflorescence 32-76 cm long; rachillae straight, 23-58 cm long; perianth of pistillate flowers wrinkled.

15. Trees 5-7 m tall; leaf rachis 100-113 cm long; 78-82 pinnae on each side; pistillate flowers rounded at anthesis; sepals with acute tips; perianth without orange dots; petals of staminate flowers more or less obovate, about 4.5 mm wide ..... 24. *S. comosa.*
15. Trees 15-20 m tall; leaf rachis 255-310 cm long; 158-163 pinnae on each side; pistillate flowers ovoid at anthesis; sepals with obtuse tips; perianth with orange dots; petals of staminate flowers ovate-lanceolate, about 3 mm wide ..... 26. *S. sancona.*

13. Pistillate flowers more or less pyramidal at anthesis.
16. Pinnae from middle series of leaf 0.5-2.0 cm wide; plants mostly without emergent stem; one species arborescent.
17. Pistillate flowers 5-9 mm long at anthesis.
18. Pinnae either densely glaucous on both surfaces or appressed white-brownish pubescent adaxially and glaucous abaxially; perianth of pistillate flowers distinctly nerved.
19. Plants usually prostrate; pinnae densely glaucous on both surfaces, 20-22 on each side; expanded part of sterile bract 15-20 cm long and 2-3 cm wide, covered with orangish punctate glands ..... 11. *S. microphylla.*
19. Plants upright; pinnae appressed white-brownish pubescent adaxially and glaucous abaxially, 34-38 on each side; expanded part of sterile bract 35-37 cm long and 4-6 cm wide, without orangish punctate glands ..... 25. *S. campylospatha.*
18. Pinnae neither glaucous on both surfaces nor pubescent adaxially, nor glaucous abaxially; perianth of pistillate flowers not nerved.
20. Pinnae from middle series 15-20 cm long, glaucous abaxially, with scattered patches of pale floccose indument; pistillate flowers with sepals longer than petals at anthesis; ovary glabrous ..... 12. *S. loefgrenii.*

20. Pinnae from middle series 28-30 cm long, not glaucous, mostly glabrous; pistillate flowers with sepals shorter than petals at anthesis; ovary tomentose... ..... 13. *S. cardenasii.*

17. Pistillate flowers 12-22 mm long at anthesis.
    21. Trees 2.0-4.0 m tall; rachillae 16-18, each 32-36 cm long; sepals of pistillate flowers frequently with prominent valvate tips; pinnae with brownish ramenta along abaxial midrib ..... 20. *S. flexuosa.*
    21. Plants usually without emergent stem; rachillae 4-9, each 10-18 cm long; sepals of pistillate flowers usually imbricate; pinnae either glabrous or with scattered patches of pale floccose indument abaxially.
        22. Pinnae from middle series 38-45 cm long, greenish and more or less glabrous, tips long acuminate, intervals between clusters mostly 3-5 cm..... 19. *S. mendanhensis.*
        22. Pinnae from middle series 15-20 cm long, glaucous and with scattered patches of pale floccose indument abaxially, tips acute, intervals between clusters mostly 1-2 cm ..... 12. *S. loefgrenii.*

16. Pinnae from middle series of leaf 2.5-4.5 cm wide; most trees 3-36 m tall; one species without emergent stem.
    23. Pistillate flowers 1.6-3.5 cm long at anthesis.
        24. Tips of pinnae mostly acute and asymmetrical; fruit 3-4 cm long, more or less spherical or turbinate.
            25. Pistillate flowers nerved, with conspicuous patches of white ramenta; pinnae from middle series 60-70 cm long, green on both surfaces; leaf rachis 210-240 cm long; fruit surface irregularly striate .....27. *S. stratincola.*
            25. Pistillate flowers smooth, without patches of white ramenta; pinnae from middle series 30-34 cm long, glaucous on one or both surfaces; leaf rachis 60-84 cm long; fruit surface more or less smooth.

26. Plants without emergent stem; leaf rachis 78-84 cm long; 60-64 pinnae on each side, glaucous adaxially, green abaxially; rachillae 5-8 in number..... ..... 17. *S. duartei.*
26. Trees 3.0-4.5 m tall; leaf rachis 55-60 cm long; 38-40 pinnae on each side, glaucous on both surfaces; rachillae 15-17 in number..... 16. *S. glaucescens.*

24. Tips of pinnae mostly acuminate and symmetrical; fruit 5-9 cm long, ovoid or ellipsoid.
27. Pistillate flowers 2.7-3.5 cm long; sepals more or less smooth; ovary tomentose; middle series pinnae 50-57 cm long, 2.5 cm wide; fruit 8-9 cm long, 4.0-4.5 cm in diameter..... 22. *S. macrocarpa.*
27. Pistillate flowers 1.7-2.2 cm long; sepals distinctly wrinkled; ovary glabrous; middle series pinnae 80-88 cm long, 3-4 cm wide; fruit 5.0-5.5 cm long, 2.5-3.0 cm in diameter..... 21. *S. oleracea.*

23. Pistillate flowers 0.5-1.2 cm long at anthesis.
28. Endocarp cavity irregularly rounded or triangular in cross section; ovary glabrous.
29. Petioles with flat, spine-like fibrous margins, arranged in 5 rows around trunk; cross veinlets not prominent on pinnae; pistillate flowers 0.9-1.2 cm long; endocarp cavity irregularly rounded in cross section; seeds ovoid .....28. *S. coronata.*
29. Petioles with fine fibrous margins, not regularly arranged in rows around trunk; cross veinlets prominent on adaxial side of pinnae; pistillate flowers 0.5-0.7 cm long; endocarp cavity triangular in cross section; seeds 3-lobed with truncate ends..... ..... 29. *S. inajai.*
28. Endocarp cavity round in cross section; ovary tomentose.
30. Leaf rachis with whitish mealy indument; middle series pinnae 80-90 cm long, 58-63 on each side; rachillae mostly 9-11, usually glabrous; petals of staminate flowers about 5.5 mm wide, without reddish punctate glands .....14. *S. cocoides.*

30. Leaf rachis more or less glabrous; middle series pinnae 50-56 cm long, 104-107 on each side; rachillae 40-60, usually with patches of pale ramenta; petals of staminate flowers about 3 mm wide, with conspicuous reddish punctate glands..... 15. *S. orinocensis.*

Description and Discussion of Species

1. Syagrus campicola (Barb. Rodr.) Becc., Agric. Colon. 10:465. 1916; Glassman, Fieldiana Bot. 31:377. *figs. 7-8, 19.* 1968. PLATE I, 3; MAP 6.

Cocos campicola Barb. Rodr., Palm. Hassler. Nov. 6. 1900; Sertum Palm. Brasil. 1: *t. 71.* 1903. Holotype: Paraguay, in campis Ipe Hu, Sierra de Maracayu, *Hassler 5057* (G).

Plants without emergent stem. Sheathing leaf base about 6 cm long; petiole 4 cm long and 0.5 cm wide, margins fibrous; leaf rachis 48-52 cm long; pinnae 14-16 on each side, regularly arranged, each one about 2.5-4.5 cm apart, grayish-green, but not glaucous, those from mid-section 30-34 cm long and 0.3-0.5 cm wide, with acuminate, asymmetrical tips. Expanded part of sterile bract 19 cm long and 1.3 cm wide, woody in texture, sulcate, brownish tomentose on outside; inflorescence unbranched, extending beyond tip of sterile bract for several mm (fruiting rachis extending 2-3 cm), flowering part 10-13 cm long. Staminate flowers 9-10 mm long on proximal part, 5-7 mm long on distal part, petals about 2 mm wide, anthers 3-4 mm long; pistillate flowers ovoid, 5.5-7 mm long and 4.0-4.5 mm in diameter, sepals shorter than petals at anthesis. Fruit ovoid, about 2 cm long and 1.1 cm in diameter, beak 5 mm long, endocarp about 1 mm thick, cavity with 1-2 locules separated by a firm partition, smooth and trivittate (when single). Mature seeds not seen.

Specimens examined. **Paraguay.** Sierra de Maracayu, *Hassler 5057* (G, holotype; BM, isotype); in Valle fluminis Y-aca in arenosis near Piribenbuy, *Hassler 6871* (G).

Flowering in October and January.

Vernacular names: none recorded.

Distribution: Endemic to Paraguay. Open grassy areas with sandy soil.

Hassler 6871 was cited by Barbosa Rodrigues (1903a). These spec-

imens are illustrated in Glassman (1968b) rather than the holotype (*Hassler 5057*) because they represent a more complete collection.

As previously mentioned, this species is most closely related to *S. leptospatha* in having no emergent stem and by having regular pinnae, simple inflorescences that extend beyond the tip of the sterile bract, 1-2 chambered fruits, and a similar leaf anatomy pattern. The main difference between the two species is the much longer (19 cm vs. 4-5 cm) woody rather than papery sterile bract in *S. campicola*. No specimens are known to exist except for those cited above, which were collected about 80 years ago. Therefore, this palm may have become extinct.

2. Syagrus leptospatha Burret, Notizbl. Bot. Gart. Berlin-Dahlem 15:105. 1940; Glassman, Fieldiana Bot. 31:380. *figs. 9, 20.* 1968.

PLATE III, 1; MAP 4.

Holotype: Brazil, Mato Grosso, Boliche Seco, Campo Grande, *Archer & Gehrt 3915* (SP-36429).

Plants without emergent stem. Sheathing leaf base about 4 cm long; petiole 13 cm long and 0.3 cm wide, margins fibrous; leaf rachis 35-37 cm long; pinnae 9 on each side, regularly arranged, each one about 2-3 cm apart, those from mid-section 33-35 cm long and 0.3-0.4 cm wide, mostly with acuminate, symmetrical tips. Expanded part of sterile bract 4-5 cm long and 0.5-1.0 cm wide, papery in texture, sulcate on lower part; inflorescence unbranched, extending beyond tip of sterile bract for as much as 14 cm, flowering part 3.0-5.5 cm long. Staminate flowers 4-5 mm long on proximal part, 3 mm long on distal part, sepals 3-4 mm long, petals about 2 mm wide, anthers 1.5 mm long; pistillate flowers round or ovoid, sepals shorter than petals at anthesis, 4.5-6.0 mm long and 4 mm in diameter. Fruit rounded, 1.0-1.4 cm long and 0.8-1.2 cm in diameter, beak about 2 mm long, endocarp 0.2-0.75 mm thick, cavity with 1-2 locules separated by a firm partition, smooth and trivittate. Seed (when single) more or less ovoid in cross-section, 8-9 mm long and 7-8 mm in diameter, or when two are present flattened laterally, 6 mm long and 7 mm in diameter.

Specimens examined. **Brazil.** MATO GROSSO: Boliche Seco, Campo Grande, Caminho Capão Bonito, 1936, *Archer & Gehrt 3915* (SP-36429, holotype; US, isotype).

Flowering in September.

Vernacular name: palmura.

Distribution: Endemic to Brazil, state of Mato Grosso. Probably grew in open grassy areas.

When Burret described this species, he did not indicate in which herbarium the cited specimen was located. He did mention, however, that the specimen was sent by F. C. Hoehne, who originally identified it as *S. campicola*. This specimen from (SP) was determined by Burret and therefore is the holotype. A duplicate of this number was sent to (US) but apparently was not seen by Burret. Hence, it is an isotype.

Syagrus leptospatha is a distinct taxon, distinguished from other species by a short, papery sterile bract and long extended rachis. It most closely resembles *S. campicola* in lacking an emergent stem and by having regular pinnae which are long and narrow, simple inflorescences which extend several cm beyond the tips of the spathes, two-chambered fruits, and a similar pattern of leaf anatomy.

In September 1976, I visited the presumed type locality, between Campo Grande and Sidrolandia, about 46 km south of Campo Grande ("Bolicho" on the maps and on sign at train station; also called "Bolicho Seco" by some of the local inhabitants). I searched all areas surrounding this small village (no definite habitat was listed in the original publication or on the herbarium sheet), but I could find no specimens of *Syagrus leptospatha*. Most of the region is presently used for agriculture and grazing, but a fairly extensive area of original, dense, cerrado vegetation remains inside a fenced-off fazenda. This palm probably grew in natural, open cerrado or campo-type vegetation rather than in dense cerrado because it is a small, trunkless palm that would probably be shaded out by taller shrubs and trees. *S. leptospatha* could not be found in the only remaining natural vegetation surrounding Bolicho Seco, nor could it be located along the road to Sidrolandia about 10-15 km to the south where some open cerrado still persists. Therefore, I concluded that this palm was rare when first collected in 1936 and is now probably extinct.

3. Syagrus acaulis (Drude) Becc., Agric. Colon. 10:465. 1916; Dahlgren, Index Amer. Palms *pl. 379*. 1959.

PLATE I, 1; MAP 3.

Cocos acaulis Drude *in* Martius, Fl. Brasil. 3:426. *t. 97, fig. 2.*

1881. Holotype: Brazil, prov. Piaui, montibus Serra Douro, *Gardner 3495* (M), (erroneously cited as *3995*).

Plants without emergent stem. Petiole and complete leaf rachis not seen; leaf with about 20-25 pinnae on each side (fide Drude), regularly arranged, those from mid-section 35-37 cm long and 1.3 cm wide, mostly with acute or acuminate, asymmetrical tips. Expanded part of sterile bract about 23 cm long and 2.5 cm wide, deeply sulcate, densely brownish pubescent, becoming glabrous with age; inflorescence simple, not branched, rachis about 18 cm long. Staminate flowers (only one observed) about 10 mm long and 5 mm wide, sepals about 1.5 mm long; pistillate flowers ovoid, 6-7 mm long and 5-6 mm in diameter, sepals slightly shorter than petals at anthesis, with broad, obtuse or acute tips. Fruits not seen.

Specimens examined. **Brazil.** GOIAS (PIAUI?): Serra do Douro, 1839, *Gardner 3495* (M, holotype; K, isotype).

Flowering in September.

Vernacular name: acumã rasteiro.

Distribution: Endemic to Brazil, state of Goias (or Piaui?). Open grassy areas.

The specimen from Munich is annotated *Cocos acaulis nov. spec.*, but the locality on the label is Piaui, Serra do Douro. It appears that *t. 97, fig. 2* was illustrated from this specimen. The locality on the Kew sheet says Goias, Serra do Douro, written by Gardner, but data on the sheet from Munich apparently was written by someone else. There is a Serra Dourada in Goias, which may be the same as Serra do Douro; therefore, I am tentatively designating the type locality as Goias.

In his original article, Drude recorded the type as *Gardner 3995*. This is undoubtedly a typographical error because both type specimens are clearly written as *Gardner 3495*.

Drude also lists *Weddell 2984* under *Cocos acaulis*. Examination of specimens from Paris indicate that they are closer to *S. petraea;* hence, they are cited under that species.

Syagrus acaulis is based on incomplete herbarium material; nevertheless, it seems to be a distinct species. It most closely resembles *S. petraea* in the trunkless habit, simple inflorescence, and size of middle pinnae; it differs from that taxon in the longer inflorescence (about

18 cm rather than 8-12 cm) and shorter pistillate flowers (6-7 mm rather than 7-14 mm), which are ovoid rather than pyramidal in shape.

Unfortunately, *S. acaulis* is known only from specimens collected in 1839 by Gardner. This palm has probably become extinct.

4. Syagrus petraea (Mart.) Becc., Agric. Colon. 10:467. 1916; Glassman, Fieldiana Bot. 31:369. 1968.

FIGS. 5, 6; PLATE IV, 1; MAPS 1, 5.

Cocos petraea Mart., Palmet. Orbign. 100: *t. 9, fig. 2.* 1844; Drude *in* Martius, Fl. Brasil. 3:426. 1881. Lectotype: Bolivia, Chiquitos, Sierra de Santiago, *D'Orbigny 21* (P).

C. petraea var. *genuina* Drude *in* Martius, Fl. Brasil. 3:426. 1881. Holotype: Brazil, between Patrocinho and Goias, *Weddell 2536* (P).

S. petraea var. *alpina* (Drude) Becc., Agric. Colon. 10:467. 1916.

C. petraea var. *alpina* Drude *in* Martius, Fl. Brasil. 3:426. 1881.

S. glazioviana var. *alpina* (Drude) Glassman, Fieldiana Bot. 31:370. 1968. Holotype: Brazil, Goias, Sertão d'Armoleite, *Weddell 2775* (P).

S. glazioviana (Dammer) Becc., Agric. Colon. 10:466. 1916; Dahlgren, Index Amer. Palms *pl. 388.* 1959; Glassman, Fieldiana Bot. 31:370. *fig. 4.* 1968.

C. *glazioviana* Dammer, Bot. Jahrb. Syst. 31:21. 1902. Lectotype: Brazil, Goias, Morro do Frota, near Meia Ponte, *Glaziou 22254* (C).

Plants without emergent stem. Sheathing leaf base 9-10 cm long; petiole 4-5 cm long, margins fibrous; leaf rachis 50-55 cm long; pinnae 11-13 on each side, not clustered, individual pinnae usually unequally distributed along rachis, those from mid-section 15-40 cm long and 0.4-1.2 cm wide, with acute or acuminate, asymmetrical or symmetrical tips. Expanded part of sterile bract 10-23 cm long and 2-3 cm wide, sulcate, peduncular part 13-19 cm long, brownish tomentose, becoming glabrous with age; inflorescence usually not branched, but occasionally with two rachillae, flowering part 6-13 cm long, peduncle 6-23 cm long. Staminate flowers 12-20 mm long on proximal part of rachis, 10-14 mm long on distal part, petals about 3 mm wide, anthers

4-5 mm long; pistillate flowers pyramidal, averaging 10-14 mm long and 4-8 mm in diameter, sepals longer than petals at anthesis. Fruit (mature?) 2-3 cm long and 1.0-1.7 cm in diameter, slightly beaked, endocarp woody, 0.5-1.0 mm thick, cavity smooth, trivittate. Seed 1.4 cm long and 1.1 cm in diameter.

Specimens examined. **Bolivia.** Province of Chiquitos: Sierra de Santiago, in rocky areas, *D'Orbigny 21* (P, lectotype of *C. petraea*; M). **Brazil.** MATO GROSSO: 1839, *Gardner 2979* (K); 100 km N of Cuiaba, cerrado, 1968, *B. Maguire, J. M. Pires, C. K. Maguire, & N. L. Silva 56393* (NY); 15 km S of Rondopolis, cerrado, associated with *Bactris,* 1976, *Glassman 13084* (CHI); Rodovia MT364, Mun. Don Aquino, cerrado, 1975, *Hatschbach 37471* (F). PIAUI: 1841, *Gardner 2970* (K). GOIAS: Sertão d'Armoleite, 1844, *Weddell 2775* (P, holotype of *C. petraea* var. *alpina*); between Cabeceira do Rio Sambambaia and Ponzo do Darbatimão, 1894, *Glaziou 22257* (C, FI, G, K, NY, P); Morro do Frota, near Meia Ponte, 1894, *Glaziou 22254* (C, lectotype of *C. glazioviana*; FI, G, K, P); *Glaziou 22255* (BR, G, K, P, US); Copelinha do S. Antonio, 1894, *Glaziou 22256* (F, K, P); Amarelas, Anápolis, 1952, *Macedo 3557* (S, SP); between Patrocinho and Goias, Campos, 1844, *Weddell 2536* (P, holotype of *C. petraea* var. *genuina*); Chapada dos Perdizes, cerrado, 1963, *Heringer 8926* (UB); Serra dos Pirineus, 75 km N of Corumbá de Goias, 1968, *H. S. Irwin, H. Maxwell, & D. C. Wasshausen 18989* (NY); 15 km N of Corumbá de Goias, 1250-1300 m alt., blocky quartzite outcrops and sandy rocky cerrado, 1973, *W. R. Anderson 10247* (UB). DISTRITO FEDERAL: Brasilia, Plano Piloto, cerrado, 1962, *Heringer 9060/1254* (SP, UB); Brasilia, Parque Nacional, cerrado seco, 1974, *Heringer & Ehrenberger 13940* (UB); 10 km SE of center of Brasilia, 1976, *Glassman & Eiten 13055* (CHI); Brasilia, cerrado, 1964, *H. S. Irwin & T. R. Soderstrom 5124* (BH, NY, US). BAHIA: 28 km W of Barreiras, cerrado, associated with *Bactris* and *Attalea,* 1976, *Glassman 13045, 13046* (CHI). PARÁ: Cachoeira do Curua, Serra do Cachimbo, Santarem-Cuiaba Hwy. BR163, red sand area, 1977, *M. J. Balick, G. T. Prance, A. S. Silva, C. C. Berg, A. J. Henderson, B. W. Nelson, R. P. Bahia, & M. R. dos Santos 914, 917* (F).

DOUBTFUL. GOIAS: between Goias and Cuyaba, 1844, *Weddell 2984* (P, paratype of *C. acaulis*); Sertão d'Amaroleite, 1844, *Weddell 2795* (P); *Weddell s.n.* (P). PARÁ: Cachimbo, 1955, *Werner Bockerman 236* (SP).

Flowering from January to September.

Vernacular names: acumão rasteiro, indaya rasteiro, coqueiro do campo, indaya do campo, ariry, guriry (Brazil).

Distribution: Native to Bolivia, province of Chiquitos; Brazil, states of Mato Grosso, Goias, Bahia, Piaui, and Pará. Usually in campos or cerrados.

As Martius did not indicate the herbarium from which the original material of *D'Orbigny 21* came, I am designating the two specimens from (P) as lectotype because the material and information are more complete than that for the specimen from (M). None of the specimens were annotated by Martius. For *Cocos glazioviana,* I have designated the specimen from (C) as the lectotype because it is the most complete collection of all the specimens cited for this number (*Glaziou 22254*); furthermore, it was determined by Dammer.

Drude (1881) did not cite his specimens directly under the description of each new variety of *Cocos petraea*; he lumped them into a separate list instead. It is clear, however, that *Weddell 2536* (P) and *Weddell 2775* (P) are the holotypes for var. *genuina* and var. *alpina* respectively, because they were determined and annotated by Drude as new varieties. Furthermore, no other specimens of these two numbers have been seen from any other herbaria.

In another article (Glassman, 1968b), I stated that *S. petraea* and *S. glazioviana* were distinct taxa because the lectotype of the former species has narrow pinnae (4-7 mm) with symmetrical tips, whereas the lectotype of *C. glazioviana* has wider pinnae (up to 11 mm) with asymmetrical tips; however, both taxa have pyramidal pistillate flowers averaging 10-14 mm long. In *Gardner 2970* and *2979,* the pinnae are only 6-7 mm wide but have asymmetrical tips. Holotype material of *C. petraea* var. *alpina* consists of two sheets; one has pinnae 5 mm wide with symmetrical tips, the other has pinnae up to 10 mm wide with asymmetrical tips; in all three numbers the pistillate flowers measure only 7-9 mm long. After comparing a number of specimens, I have concluded that the lectotype of *C. glazioviana* (*Glaziou 22254*-C), along with several other specimens cited, are representatives of *S. petraea* that apparently grew under favorable conditions, whereas specimens mentioned above with narrower pinnae, symmetrical tips, and smaller pistillate flowers are either immature or underdeveloped specimens that probably grew under adverse environmental condi-

tions. Other specimens studied later and evidence from leaf anatomy also indicate that *S. petraea* and *S. glazioviana* are synonymous.

As already noted, *S. petraea* varies widely in appearance, probably due in part to the amount of moisture available during the growing season. *Heringer 8926* (UB) appears to have been subjected to severe drought conditions. The pinnae are short (15-16 cm), close together, but not clustered; the sterile bract is thick (3 mm) and short (10-12 cm); the inflorescence (rachis) is short (6-7 cm) and the pistillate flowers are only 9-10 mm long. *Heringer 9060/1254* (UB) has similar measurements. On the other extreme, *Glassman 13045* (CHI) seems to have grown under more favorable moisture conditions. The pinnae are long (38-40 cm) and farther apart, the sterile bract is relatively thin (1 mm) and long (23 cm), the inflorescence (rachis) is relatively long (13 cm), but the pistillate flowers have set fruit.

This taxon closely resembles *S. acaulis* because both have unbranched inflorescences and a similar leaf anatomy pattern; they can be distinguished mainly by differences in size and shape of pistillate flowers. *Syagrus petraea* may also be closely related to *S. graminifolia*. They are sympatric in similar habitats in at least three Brazilian states, and they are frequently mixed up in the same collections. The two taxa are distinguished from each other primarily by inflorescences with 2-7 rachillae rather than mostly unbranched inflorescences and by distinctive leaf anatomy patterns. It is not certain whether *S. petraea* and *S. graminifolia* hybridize where their ranges overlap. I have not recognized any hybrid specimens nor have I seen any published information on this subject. It is possible, however, that occasional specimens of *S. petraea* with two rachillae could be the result of hybridization. Further investigation and additional collections are necessary before this theory can be corroborated.

5. Syagrus lilliputiana (Barb. Rodr.) Becc., Agric. Colon. 10:467. 1916.

FIGS. 3, 4; PLATE III, 2; MAP 7.

Cocos lilliputiana Barb. Rodr., Palm. Hassler. Nov. 5. 1900; Sertum Palm. Brasil. 1:96. *t. 69A*. 1903. Holotype: Paraguay, in campis ad ripam fluvium Capibary, *Hassler 4458* (G).

Plants without emergent stem, but subterranean stem about 6 cm

long and 2.5 cm thick. Petiole about 2 cm long and 0.5 cm wide, margins fibrous; leaf rachis 22-25 cm long; pinnae 9-10 on each side, regularly arranged, glabrous on both surfaces, those near mid-section 33-37 cm long and 0.8 cm wide, with acute, asymmetrical tips. Expanded part of sterile bract 6.5 cm long and 2 cm wide, deeply sulcate, brownish tomentose, becoming glabrous with age; branched part of inflorescence 5 cm long, rachillae 3-4 in number, each 3.0-4.5 cm long. Staminate flowers 6-8 mm long; pistillate flowers pyramidal, sepals longer than petals at anthesis, distinctly nerved, 6-7 mm long and 4-6 mm in diameter, ovary tomentose. Fruit (immature) ovoid, 1.2 cm long, 0.7-0.8 cm in diameter, short beaked. Seeds not seen.

Specimens examined. **Paraguay.** Capibary, 1898-99, *Hassler 4458* (G, holotype); without definite locality, 1905, *Hassler 9519* (G).

Flowering in September.

Vernacular names: none recorded.

Distribution: Endemic to Paraguay. Mostly in grasslands.

As previously discussed, this palm seems to be most closely related to *S. graminifolia,* both morphologically and anatomically. It differs mainly in its smaller dimensions, pistillate flowers with distinctly nerved sepals, tomentose rather than glabrous ovary, and single-seeded rather than 1-2 seeded fruits.

Syagrus lilliputiana is probably the smallest known species in the genus with a leaf rachis no more than 25 cm long. According to Barbosa Rodrigues (1900), this palm lives among grasses in the campos that are subjected to periodic burning and grazing. He implies that these two factors do not allow the plants to grow to their full natural size. Unfortunately, more information about this species is not currently available because it probably has become extinct. The last known collection was made in 1905.

6. Syagrus graminifolia (Drude) Becc., Agric. Colon. 10:466. 1916; Dahlgren, Index Amer. Palms *pl. 389.* 1959; Glassman, Fieldiana Bot. 31:374. *figs. 5-6, 18.* 1968.

PLATE II, 5; MAP 9.

Cocos graminifolia Drude *in* Martius, Fl. Brasil. 3:415. *t. 91.* 1881. Holotype: Brazil, Piaui, near R. Paranahyba, between S. Domingos and Borda do Mato, *Burchell 5956* (K).

S. graminifolia var. *glazioviana* (Dammer) Becc., Agric. Colon. 10:466. 1916; Dahlgren, Index Amer. Palms *pl. 390*. 1959.

C. graminifolia var. *glazioviana* Dammer, Bot. Jahrb. Syst. 31:23. 1902. Holotype: Brazil, Goias, entre Lagoa do Piquiero et Buraco da Onça, *Glaziou 22253* (C).

S. graminifolia var. *nana* (Drude) Becc., Agric. Colon. 10:466. 1916; Glassman, Fieldiana Bot. 31:376. 1968.

C. *graminifolia* var. *nana* Drude *in* Martius, Fl. Brasil. 3:415. *t. 91*. 1881. Holotype: Brazil, entre Goias and Cuyaba, *Weddell 2995* (P).

Plants without emergent stem. Sheathing leaf base 9-10 cm long; petiole 13-15 cm long and 0.4 cm wide, margins fibrous; leaf rachis 65-70 cm long; pinnae 23-25 on each side, usually regularly arranged, those from mid-section 35-40 (55) cm long and 4-7 mm wide, mostly with long acuminate, symmetrical tips, occasionally asymmetrical. Expanded part of sterile bract 30-39 cm long and 2.5 cm wide, sulcate; branched part of inflorescence 28-30 cm long, rachillae 2-7 in number, each 15-18 cm long. Proximal staminate flowers 8-10 mm long, those on distal half 4-7 mm long, petals 3-4 mm wide, anthers 4 mm long; pistillate flowers pyramidal, sepals longer than petals, obscurely nerved, 9-13 mm long and 4-7 mm in diameter. Mature fruit about 2 cm long and 1.3 cm in diameter, slightly beaked, endocarp about 1 mm thick, cavity with 1-2 locules, separated by a firm partition (when 2 locules present). Seeds not seen.

Specimens examined. **Brazil.** PIAUI: near Paranahyba River, between S. Domingos and Borda do Mato, *Burchell 5956* (K, holotype of *C. graminifolia;* BR, P); GOIAS: Catalão, 1834, *I. Riedel & B. Luschnatt s.n.* (LE, paratype of *C. graminifolia*); Chapada de Catalão, cerrados, região do Paranaiba, 1892, *Uhle 794* (R); entre Goias and Cuyaba, 1844, *Weddell 2995* (P, holotype of var. *nana*); campos entre Patrocinho and Goias, 1844, *Weddell 2541* (P, paratype of var. *nana*); Copelinha do S. Antonio, 1894, *Glaziou 22252* (C, FI, G, K, P); entre Lagoa do Piquiero and Buraco do Onça, in campis, 1895, *Glaziou 22253* (C, holotype of var. *glazioviana;* F, FI, G, K, P); Pichoa, *Glaziou s.n.* (P); Rodovia Brasilia-Anápolis, cerrado, *Heringer 10-476, 11-848* (UB), *R.P. Belém 2029* (UB); MATO GROSSO: Aquidauana, common, cerrado and along railroad, 1946, *Swallen 9520* (US); 24 km S of Sidrolandia, road to Maracaju,

cerrado, 1976, *Glassman 13093* (CHI); 28 km S of Sidrolandia, near Fazenda Santa Luzia, pasture, cleared cerrado, *Glassman 13094* (CHI).

DOUBTFUL. GOIAS: between Goias and Cuyaba, *Weddell 2995* (F).

Flowering from June to December.

Vernacular name: acumão rasteiro.

Distribution: Native to Brazil, states of Piaui, Goias, and Mato Grosso. Mostly in campos or cerrados.

Burchell 5956 is the first collection cited by Drude (1881) under *C. graminifolia,* and the specimen from Kew is listed here as the holotype because it was determined by Drude as a new species in 1877. The specimen from Paris is an isotype because the sheet is inscribed "gift from Kew" without annotations by Drude. Dammer (1902) listed *Glaziou 22253* under *C. graminifolia* var. *glazioviana* but did not indicate where it was deposited. The specimen from Copenhagen, however, was the only one of those seen that was determined and annotated by Dammer (see Dahlgren 1959, *pl. 390*). Therefore, it is the holotype.

In describing *C. graminifolia* var. *nana,* Drude (1881) cited *Weddell 2541* and *2995* together. However, *Weddell 2995* (P) was determined and annotated by Drude and included sketches by Weddell, whereas *Weddell 2541* (P) does not bear any of these annotations. Therefore, *Weddell 2995* (P) is the holotype. *Weddell 2995* (F) is cited here under "Doubtful" specimens because it has both branched and unbranched inflorescences, which indicates a possible mixup of collections. It probably is often confused with *Syagrus petraea,* which usually has unbranched inflorescences. This variety (*nana*) was originally separated from *C. graminifolia* by its smaller flowers, narrower sterile bracts, and fewer rachillae. After comparing a number of specimens, I have concluded that both *Weddell 2541* (P) and *2995* (P) are underdeveloped specimens that probably grew under adverse environmental conditions.

Syagrus graminifolia appears to be most closely related to *S. lilliputiana,* both morphologically and anatomically. The two species differ mainly in the smaller dimensions, distinctly nerved pistillate calyx, and pubescent ovary of *S. lilliputiana.*

7. Syagrus vagans (Bondar) Hawkes, Arq. Bot. S. Paulo 2:178. 1952; Glassman, Phytologia 39:406. *figs. 15-17.* 1978.

PLATE IV, 6; MAP 8.

Cocos vagans Bondar, Field Mus. Nat. Hist., Bot. 22:457. 1942.

Lectotype: Brazil, Bahia, 1941, *Bondar s.n.* (F-619777). cf. Glassman 1972b, p. 95.

Plants without emergent stem, usually caespitose. Sheathing leaf base 30-32 cm long, margins fibrous, intermixed with short teeth; petiole 76-80 cm long, about 1.5 cm wide near base, margins armed with short teeth for at least the proximal third of its length, sometimes edentate, fibrous for remaining two-thirds; leaf rachis 100-110 cm long; pinnae 34-36 on each side, usually regularly arranged, glaucous on both surfaces, those from mid-section 40-54 cm long and 2.0-2.5 cm wide, mostly with acute, asymmetrical tips. Expanded part of sterile bract 85-106 cm long and 8 cm wide, sulcate, brownish tomentose or glaucous, peduncular part 100-107 cm long; branched part of inflorescence 60-65 cm long, rachillae 42-46 in number, each 41-43 cm long, peduncle 105-107 cm long. Staminate flowers 4-7 mm long on proximal part, 3-4 mm long on distal part, petal 3 mm wide, with obscure reddish dots, anthers 2 mm long; pistillate flowers rounded, 5-7 mm long and 5-7 mm in diameter, sepals longer than petals at anthesis, sepals and petals more or less nerved on distal half, smooth on proximal half. Fruit elliptical-ovoid, 2.8-3.7 cm long and 1.5-1.8 cm in diameter, beak 2-3 mm long, endocarp woody, 1-2 mm thick along sides, one locule. Seed angular or round in cross section, 1.9-2.4 cm long and 0.8-1.0 cm in diameter.

Specimens examined. **Brazil.** BAHIA: 1941, *Bondar s.n.* (F-619777); Santa Teresinha, 1941, *Bondar s.n.* (F-619778, 620715, 620752); 1931, *Bondar 1559* (SP); 30 km N of Jequié, para Milagres, 1965, *Belém & Mendes 242* (BH); 20 km N of Lagedo Alto, caatinga, common, 1969, *Glassman & Costa 8709* (CHI); 5-10 km W of Lagedo Alto, caatinga, abundant, 1969, *Glassman & Costa 8710-8713* (CHI); 20 km N of Maracás, Morros, in caatinga, very local or sparse, 1969, *Glassman & Costa 8717-8719* (CHI); 22 km E of Brumado, caatinga, about 50 clumps seen, 1969, *Glassman & Costa 8725, 8726* (CHI).

CULTIVATED. **United States.** FLORIDA: Fairchild Tropical Garden, *Moore 7715, 8965, 9372* (BH); *Read 1371* (BH, FAIR).

Flowering from January to August.

Vernacular names: ariri, licurioba.

Distribution: Brazil, in the east-central part of Bahia, from Lagedo Alto and Santa Teresinha on the north and east, Jequié to the south, and southwest to Brumado; associated with *Syagrus coronata* (Mart.) Becc.

over much of its range, and hybridizes with it near Lagedo Alto to produce *Syagrus* × *matafome* (Bondar) Glassman. Confined to caatingas.

Bondar (1942a) cited all specimens for each new species described (four species of *Cocos* and four species of *Attalea*) as isotypes deposited in the Field Museum. From this information, it was assumed that at least one other set of specimens existed in Brazil. After searching over a period of years, however, I have been unable to locate any other sets of specimens for the taxa described in the above article. Therefore, I have designated all specimens called isotypes by Bondar (1942a) as lectotypes.

Syagrus vagans seems to be more closely related to *Arikuryroba schizophylla* than other species of *Syagrus* because of the similarity in size and shape of both staminate and pistillate flowers, the spiny petiole margins, and an almost identical leaf anatomy pattern, but it can be distinguished by its trunkless habit, narrower pinnae, smaller and sparser spines confined to the proximal third of the petiole margins, and homogeneous endosperm. Apparently, this palm is also related to others with a similar leaf anatomy pattern, which is discussed in detail under *S. harleyi*. *S. vagans* is one of the tallest trunkless species of *Syagrus*. Both leaves and inflorescences usually measure more than 2 m high.

8. Syagrus harleyi Glassman Phytologia 39:401. *fig.* 7. 1978.

FIG. 9; MAP 4.

Holotype: Brazil, Bahia, Serra do Sincorá, 3 km S of Mucugé, *R. M. Harley, S. A. Renvoize, C. M. Erskine, C. A. Brighton, & R. Pinheiro 15963* (K).

Plants without emergent stem. Sheathing leaf base 25-30 cm long; petiole 33 cm long and 1 cm wide, margins smooth or fibrous; leaf rachis 93-136 cm long; pinnae 25 on each side, those from mid-section more or less evenly spaced, regularly arranged, 43 cm long and 2.5 cm wide, mostly with acute, asymmetrical tips, dark green above, glaucous below. Expanded part of sterile bract 34-51 cm long and 3-5 cm wide, sulcate, more or less glabrous, peduncular part 45-63 cm long; branched part of inflorescence 17-36 cm long, rachillae 17-22 in number, each 6-14 cm long, peduncle 68 cm long. Staminate flowers 5-6 mm long on proximal part of rachilla, 4-5 mm long on distal part; pistillate flowers rounded, 4.5-6 mm long and 4.5-5 mm in diameter, calyx and corolla more or less nerved, about equal in size. Fruits 8-10 per rachilla, im-

mature ones ovoid, 1.5 cm long and 1.1 cm in diameter, covered with brown tomentum (mature fruits orange, 2.5 cm long and 2.5 cm in diameter), endocarp cavity trivittate, endocarp bony, 1-2 mm thick; usually one-seeded, occasionally two-seeded. Seeds 6-7 mm long and 5 mm in diameter.

Specimens examined. **Brazil.** BAHIA: Serra do Sincorá, by Rio Cumbuca, about 3 km S of Mucugé, riverside, damp sandy soil, sandstone rocks and partly burnt-over vegetation, 850 m alt., 1974, *R. M. Harley, S. A. Renvoize, C. M. Erskine, C. A. Brighton, & R. Pinheiro 15963* (K, holotype; BH, F, MO, NY, US, isotypes); S of Andarai, 16 km along road to Mucugé, near small town of Xique-Xique, sandstone rocks intersected by small streams, 700-900 m alt., 1977, *R. M. Harley, S. J. Mayo, R. M. Storr, T. S. Santos, & R. S. Pinheiro 18696* (K).

Flowering in February.

Vernacular names: none recorded.

Distribution: Brazil, state of Bahia, common along road between Mucugé and Andarai, approximately 4°19′W, 12°54′S. Along streams in sandy soil and sandstone rocks, a conspicuous element in the "campo rupestre" vegetation.

Syagrus harleyi seems to be most closely related to *S. werdermannii*. Bondar (1964) thought that he had observed *S. werdermannii* in Mucugé, but he probably saw *S. harleyi*. This palm also appears to be allied to a group of species with a similar leaf anatomy pattern, i.e., *S. vagans, S. ruschiana,* and *Arikuryroba schizophylla* (Glassman, 1972a), as well as *S. microphylla* (Glassman, 1977d) and *S. werdermannii*. Adaxial nonvascular fibers occur as common, elongate clusters, whereas abaxially the fibers appear as much smaller, spherical clusters, which are only about one-half as common as the adaxial fibers. Of the six taxa, *S. harleyi* is the most distinctive, i.e., clusters of adaxial nonvascular fibers are unequal in size, thicker, and not as common as in the others.

Originally, the above taxa may have had a common ancestor, but their morphological characteristics evolved much more rapidly than the anatomical characteristics, which remained relatively unchanged. Even though this group of species is linked by a unique leaf anatomy pattern (for *Syagrus*), each taxon can be distinguished morphologically, for the most part. One of the species, *A. schizophylla,* is included in another genus (*Arikuryroba*) because of its densely spiny petiole margins and ruminate endosperm. *S. microphylla* has clustered rather than regularly arranged middle series pinnae and pyramidal rather than ovoid or rounded pis-

tillate flowers. *S. vagans* has teeth along the lower third of its petiole margins, whereas the other four species of *Syagrus* have completely edentate margins.

Besides their similar leaf anatomy pattern, the five taxa of *Syagrus* under consideration and *A. schizophylla* have the following morphological characteristics in common: sterile bracts sulcate, pistillate flowers 4-8 mm long and 3-7 mm in diameter, staminate flowers 2-6 mm long above and 4-9 mm long below, and pinnae 0.8-4.0 cm wide with asymmetrical tips.

The above species of *Syagrus* and *A. schizophylla* occur mostly in Bahia, but *S. ruschiana* is found in the adjacent states of Espirito Santo and Minas Gerais. Apparently, none have overlapping ranges since most of the taxa have limited distributions. *Syagrus vagans* is very common in caatingas between Brumado and Lagedo Alto in east-central Bahia, *S. werdermannii* is endemic to caatingas in the Caetitê area in Central Bahia, *S. harleyi* is confined to sandy soil or sandstone rocks near streams in a small area between Mucugé and Andarai, *S. microphylla* is endemic to caatingas in the Morro de Chapeu area, *S. ruschiana* is endemic to black gneissic rocks in limited areas of Espirito Santo and adjacent Minas Gerais, and *A. schizophylla* is found only in the coastal forest and along the strand in Bahia and adjacent Pernambuco.

As previously discussed, I considered placing the above taxa in a separate section of the genus *Syagrus,* but this alliance is not satisfactory because they do not seem to comprise a clear-cut homogeneous group, morphologically. They are also kept separate because *Syagrus,* as a whole, cannot be satisfactorily divided.

9. Syagrus werdermannii Burret, Repert. Sp. Nov. 32:109. 1933; Notizbl. Bot. Gart. Berlin-Dahlem 13:682. 1937; Glassman, Fieldiana Bot. 34:1. *figs. 1-9.* 1971; Phytologia 39:408. 1978.

PLATE V, 1; MAP 1.

Holotype: Brazil, Bahia, Caetitê, *Werdermann 3742* (B, destroyed). Neotype: Situ do Ouro, 15 km NW of Caetitê, *Glassman & Costa 8728* (CHI). cf. Glassman 1971a, p. 7.

Plants without emergent stem, caespitose. Sheathing leaf base about 20 cm long; petiole 34-36 cm long and 1 cm wide, margins smooth or fibrous; leaf rachis 56-60 cm long; pinnae 18-20 on each side, those from mid-section usually regularly arranged, 40-45 cm long and 1-2 cm

wide, with acute, asymmetrical tips, glaucous on both surfaces, becoming green with age. Expanded part of sterile bract 40-48 cm long and 3-5 cm wide, sulcate, covered with dense brown tomentum, becoming glabrous with age. Branched part of sterile bract 30-40 cm long, rachillae 11-14 in number, each 22-25 cm long, peduncle 50-72 cm long. Staminate flowers 6-7 mm long on proximal part of rachilla, 4-5 mm long on distal part, petals about 3 mm wide, anthers 3-3.5 mm long; pistillate flowers rounded or ovoid, sepals and petals about same length at anthesis, both distinctly nerved, 4-6 mm long and 4 mm in diameter. Mature fruits ovoid or obovoid, 1.8-2.5 cm long and 1.3-1.5 cm in diameter, beak 4 mm long, endocarp woody, 1.0-1.5 cm thick, one locule. Seed not seen.

Specimens examined. **Brazil.** BAHIA: Situ do Ouro, 15 km NW of Caetitê, about 100 clumps seen in caatinga, associated with *Bactris tucum*, 1969, *Glassman & Costa 8728* (CHI, neotype); *8729-8739* (CHI).

Flowering in July.

Vernacular name: coco da vassoura.

Distribution: Brazil, state of Bahia, within an approximate 80-km radius of Caetitê. Endemic to caatingas.

In his original article, Burret (1933) said that this taxon appeared to be related to *Syagrus petraea*, a trunkless palm with regularly arranged pinnae and unbranched inflorescences. In a later article (Glassman, 1971a), I linked *S. werdermannii* with another trunkless species, *S. campylospatha*. More recently (Glassman, 1977d, 1978b), I have shown that *S. werdermannii* is more closely related to *S. harleyi* and other species with a similar leaf anatomy pattern.

10. Syagrus ruschiana (Bondar) Glassman, Rhodora 65:261. 1963; Glassman, Phytologia 39:404. *figs. 8-10*. 1978.

PLATE IV, 3; MAP 8.

Cocos ruschiana Bondar, Bol. Inst. Centr. Fomento Econ. Bahia 9:45. *figs. 10-13*. 1941.

Arikuryroba ruschiana (Bondar) Toledo, Arq. Bot. S. Paulo 2:6. 1944. Lectotype: Brazil, Espirito Santo, Colatina and S. Mateus, 1941, *Bondar s.n.* (F-620822). cf. Glassman 1972b, p. 94.

Trees 4-8 m tall, 4-12 cm in diameter, usually caespitose. Sheathing leaf base 30-36 cm long; petiole 90-103 cm long, about 1.5 cm wide

near base, margins fibrous or smooth, not spiny; leaf rachis 163-200 cm long, pinnae 50-54 on each side, regularly arranged, ones from mid-section 50-53 cm long and 2.4-3.5 cm wide, with acute, asymmetrical tips, usually glaucous on both surfaces, becoming green with age. Expanded part of sterile bract 100-110 cm long and 5-6 cm wide and about 1 mm thick, more or less brittle in texture, sulcate, whitish-brown tomentose to glaucous, peduncular part 68-70 cm long; branched part of inflorescence 90-98 cm long, rachillae 80-100 in number, each 50-55 cm long, peduncle 70-74 cm long. Staminate flowers 8-9 mm long on proximal part of rachilla, 3-6 mm long on distal part, petals about 2 mm wide, with unevenly distributed reddish glandular dots, sepals irregular in size and shape, 0.5-2.5 mm long, anthers about 2 mm long; pistillate flowers rounded or ovoid, 3.5-6 mm long and 3.5 mm in diameter, petals and sepals approximately the same size at anthesis, distinctly nerved. Mature fruit 2.5 cm long and 2.0 cm in diameter, very short beak, endocarp cavity trivittate, smooth, endocarp 1-2 mm thick. Seed 1.4 cm long and 1.3 cm in diameter.

Specimens examined. **Brazil.** ESPIRITO SANTO: Colatina and S. Mateus, 1941, *Bondar s.n.* (F-620822); 1946, *Bondar s.n.* (F-404604-5); 13 km E of Colatina (5 km W of Baunelha), confined to black gneissic rocks, associated with columnar cacti, about 100 trees seen, 1969, *Glassman & Costa 8743* (CHI). MINAS GERAIS: Rodovia Nanuque-Teofilo Otoni, serra rochosa, 1965, *Belém 1628* (BH, UB).

DOUBTFUL. ESPIRITO SANTO: Colatina, 1943, *J.G. Kuhlman s.n.* (RB-62960)—without leaves.

Flowering from July to December.

Vernacular names: colatina, coco de pedra.

Distribution: Native to Brazil in restricted areas of Espirito Santo and adjacent Minas Gerais. Apparently confined to black gneissic rocks.

No specimens were cited by Bondar in his original article (1941); therefore, his earliest collection was designated as lectotype. Bondar originally described *S. ruschiana* as having seeds with ruminate endosperm, which later prompted Toledo (1944) to transfer this species to the genus *Arikuryroba*. Bondar was in error because the endosperm is homogeneous. Even though this taxon has homogeneous endosperm and smooth petiole margines, it seems to be more closely related to *A. schizophylla* (with ruminate endosperm and spiny petiole margins) than to other species of *Syagrus* because other morphological characteristics are similar and the leaf anatomy pattern in both species is almost identical.

However, it is also linked to other species of *Syagrus* by its similar leaf anatomy pattern, as discussed under *S. harleyi*.

Bondar (1964) gave the following locality data for *S. ruschiana*: in gneissic rocks on the banks of Rio Doce in Colatina and in the municipio of São Mateus, about 1000 m alt. In 1969, I was unable to find this palm in the above localities, but only in the area I have previously cited (about 5 km W of Baunelha).

11. Syagrus microphylla Burret, Repert. Sp. Nov. 32:111. 1933; Glassman, Phytologia 38:66. *fig. 1.* 1977; 39:409. 1978.
FIG. 10; PLATE III, 4; MAP 2.

Holotype: Brazil, Bahia, Serra do Espinhaço, Östlich, Monte Chapeo, open plain, April 1932, *Werdermann 3366* (B, destroyed). Neotype: Brazil, Bahia, Serra do Tombador, 6 km S of town of Morro de Chapeu, 1100 m elevation, 1971, *H. S. Irwin, R. M. Harley, & C. L. Smith 32470* (UB). cf. Glassman 1977d, p. 66, *fig. 1.*

Plants without emergent stem, usually with a prostrate or flattened appearance. Sheathing leaf base 10-13 cm long; petiole 7-12 cm long, margins smooth; leaf rachis 29-45 cm long, covered with brownish indument; pinnae 20-22 on each side, those from mid-section in clusters of 2-3, densely glaucous on both sides, 10-22 cm long and 0.8-2.0 cm wide, acute, asymmetrical tips. Expanded part of sterile bract 15-20 cm long and 2-3 cm wide, sulcate, outer surface covered with brownish indument and dotted with orangish punctate glands, peduncular part 23-30 cm long; branched part of inflorescence 9-13 cm long, peduncle 17-31 cm long, covered with brownish indument, rachillae 4-7 in number, lower ones 5-11 cm long. Staminate flowers 4-6 mm long, sepals 0.5-1 mm long, petals about 2 mm wide, anthers about 3 mm long; pistillate flowers pyramidal, sepals and petals about equal in size at anthesis, nerves more or less distinct, 5-7 mm long and 3-5 mm in diameter. Fruits range from rounded to ovoid, 1.5-2.2 cm long and 1.0-1.3 cm in diameter, persistent perianth 0.5-0.7 cm high, endocarp woody, about 1 mm thick, one locule. Seed not seen.

Specimens examined. **Brazil.** BAHIA: Serra do Tombador, 6 km S of town of Morro de Chapeu, 1100 m elevation, 1971, *H. S. Irwin, R. M. Harley, & C. L. Smith 32470* (UB, neotype; BH, NY, isoneotypes); Serra do Tombador, 2 km SW of Morro de Chapeu, on road to Utinga,

caatinga vegetation associated with *Allagoptera* and various cacti, very local for radius of about 5 km on white sandy soil, common here, 1976, *Glassman 13018-13021, 13023, 13025-13030* (CHI, SP); same general locality, 1979, *Hatschbach 42345* (F).

Flowering from February to August.

Vernacular names: none recorded.

Distribution: Brazil, state of Bahia, mostly confined to the Morro de Chapeu mountain area. Primarily on white sandy soil in the caatinga. Harley and Mayo (1980) also reported this taxon from Serra de Curral Feio, the next mountain range north of Morro de Chapeu.

Burret (1933) erred when he placed Monte Chapeo (Morro de Chapeu) in the Serra do Espinhaço. No mountain range of this name exists in the area, but there is a Serra do Espinhaço running through Diamantina, Minas Gerais. Morro de Chapeu properly belongs in the Serra do Tombador mountain range. The above cited specimens match Burret's description of *S. microphylla* fairly closely and undoubtedly were collected in the same general area of the type locality; therefore, I have chosen one of these specimens (*H. S. Irwin, R. M. Harley, & C. L. Smith 32470*) as the neotype.

Syagrus microphylla is a distinct species; nevertheless, its leaf anatomy pattern links it to five other taxa discussed under *S. harleyi*.. Its closest relatives are probably *S. harleyi* and *S. werdermannii,* but it can be distinguished from them by its prostrate habit, short clustered pinnae, relatively short peduncle, inflorescence with only 4-7 rachillae, and pyramidal pistillate flowers.

12. Syagrus loefgrenii Glassman, Fieldiana Bot. 31:240. *fig. 4.* 1967; 31:364. 1968 (corrected from *S. lofgrenii*); 34:24. *figs. 1-11.* 1971.

PLATE III, 3; MAP 9.

Holotype: Brazil, São Paulo, Rio Claro, *Löfgren 573* (SP-12260). cf. Glassman 1971b, *fig. 1.*

S. rachidii Glassman, Fieldiana Bot. 31:245. *figs. 5, 6, 7b.* 1967. Holotype: Brazil, São Paulo, Pirassununga, *Rachid s.n.* (SP-53520).

Plants usually without emergent stem, but occasionally with trunk up to 0.5 m high. Sheathing leaf base 15-26 cm long; petiole 15-27 cm long (up to 50 cm long in juvenile leaves) and 0.6-0.8 cm wide, margins

smooth or fibrous; leaf rachis 35-70 cm long, at first covered with dense pale floccose indument which becomes reduced to scattered patches as plant matures; pinnae 26-66 on each side, mostly in clusters of 2-4, those from mid-section averaging 15-20 cm long and 0.5-1.3 cm wide, glaucous abaxially, becoming green with age, also with scattered patches of pale floccose indument, mostly with acute, asymmetrical tips. Expanded part of sterile bract averaging 15-18 cm long and 3-6 cm wide, sulcate, brownish tomentose, becoming glabrous with age; branched part of inflorescence mostly 10-13 cm long, rachillae averaging 4-6 in number, each 10-18 cm long. Staminate flowers 7-17 mm long on proximal part, 4-10 mm long on distal part, petals about 2 mm wide, anthers about 3 mm long; pistillate flowers pyramidal, sepals longer than petals at anthesis, 8-14 mm long and 5 mm in diameter in some populations, 14-18 mm long and 6-7 mm in diameter in others. Immature fruit 2 cm long and 1 cm in diameter, beak 4 mm long, covered with dark brown scaly indument combined with layer of pale floccose indument, endocarp about 0.5 mm thick, cavity smooth, trivittate. Seed not seen.

Specimens examined. **Brazil.** SÃO PAULO: Rio Claro, Campo, 1888, *Löfgren 573* (SP-12260, holotype); Anhembi, Fazenda Barreiro Rico, 1956, *M. Kuhlmann 3964* (SP); Campo Alegre, 1940, *Toledo & Gehrt s.n.* (SP-43184, F, US); Pirassununga, Campo Cerrados da Bôa Vista, 1947, *M. Rachid s.n.* (SP-53520, holotype of *S. rachidii*); Pirassununga, 1947, *M. Kuhlmann 1572* (SP); 9-11 km NW of Pirassununga, cerrado, 1969, *Glassman 8748-8751* (CHI); Itirapina, 1965, *J. Elias de Paula 117* (SP); Sertão de Itirapina, 12 km NW of city, in burned-over savanna, 1965, *Glassman & Gomes 8011-8013, 8015, 8016* (CHI).

Flowering from May to November.

Vernacular names: none recorded.

Distribution: Endemic to Brazil, state of São Paulo. Campos or cerrados.

This species varies widely in appearance as attested by the range of measurements in the description. Significant differences in individuals are probably a response to two important environmental factors—availability of soil moisture and incidence of fire. This subject has been previously discussed in more detail by Glassman (1971b) when *S. rachidii* was reduced by synonymy.

Syagrus loefgrenii seems to be most closely related to *S. cardenasii* from Bolivia. Both taxa are essentially trunkless and have similar leaf anatomy patterns; they differ mainly in pinnae length and pubescence, relative

length of perianth on pistillate flowers, and pubescence of the ovary. Apparently, *S. loefgrenii* is also allied to *S. cocoides,* especially in similarity of leaf anatomy pattern, even though the latter is an arborescent species.

13. Syagrus cardenasii Glassman, Fieldiana Bot. 31:238. *figs. 2, 7A.* 1967.

PLATE I, 5; MAP 6.

Holotype: Bolivia, Prov. of Chuquisaca, *M. Cardenas 5500* (BH).

Plants apparently without emergent stem. Petiole 38 cm long and about 1 cm wide, margins fibrous; leaf rachis about 57 cm long, pinnae 32 on each side, in clusters of 2-3, grayish green above, but not glaucous, yellowish-green below, those from mid-section about 30 cm long and 0.75 cm wide, mostly with acuminate, asymmetrical tips. Expanded part of sterile bract 31 cm long and 3.3 cm wide, sulcate and brownish-tomentose to glabrous; branched part of inflorescence 24 cm long, rachillae 9-11 in number, each 15 cm long. Staminate flowers 8-10 mm long on proximal part of rachilla, 5.0-7.5 mm long on distal part; petals more or less fleshy, sepals irregular in size, 2-4 mm long, anthers about 3 mm long. Pistillate flowers more or less pyramidal, 8-10 mm long and 6-8 mm in diameter, sepals shorter than petals at anthesis, ovary tomentose. Mature (?) fruit about 2.2 cm long, 1.6 cm in diameter, slightly beaked, endocarp bony, 2.0-2.5 mm thick along sides, 3.0-3.5 mm thick at extremities, cavity trivittate, terete and smooth. Seed about 1.1 cm long and 0.75 cm in diameter.

Specimens examined. **Bolivia.** CHUQUISACA: between Monteagudo and Muyupampa, 1800 m alt., dry forest, sloping terrain, 1959, *M. Cardenas 5500* (BH).

Flowering in May.

Vernacular name: motzcuchi.

Distribution: Endemic to Bolivia. Dry forests.

This taxon is known only from the type collection, hence it is difficult to compare with other species. It seems to be most closely related to *S. loefgrenii* and *S. cocoides* and is discussed in more detail under those species.

14. Syagrus cocoides Mart., Hist. Nat. Palm. 2:130. *t. 89-90.* 1826.

FIG. 2; PLATE I, 6; MAPS 7, 9.

Lectotype: Brazil, Pará, Rio Negro ad Almeirim, *Martius s.n.* (M). cf. Dahlgren 1959, *pl. 381.*

S. cocoides var. *linearifolia* Barb. Rodr., Enum. Palm. Nov. Valle Amaz. 40. 1875. ("Cyagrus"). Sertum Palm. Brasil. 2: *t. 73B.* 1903. Type: Brazil, ad fl. Trombetas, Agua Fria, *Barbosa Rodrigues 380* (destroyed). Lectotype: Barb. Rodr., *ibid. t. 73B.* 1903. cf. Glassman 1972b, p. 210.

Cocos syagrus Drude *in* Martius, Fl. Brasil. 3:406. 1881. A substitute name for *S. cocoides* Mart.

C. weddellii Drude *in* Martius, *ibid.* 311. *t. 90.* 1881. Holotype: Brazil, Goias, Sertão d'Amaroleite, *Weddell 2690* (P).

C. drudei Becc., Malpighia 1:445. 1887.

S. drudei (Becc.) Becc., Agric. Colon. 10:466. 1916; Dahlgren, Index Amer. Palms *pl. 385.* 1959. A substitute name for *C. weddellii* Drude because of *C. weddelliana* H. Wendl. *in* T. Moore, Florist & Pomol. 1871:114. 1871.

S. brachyrhyncha Burret, Notizbl. Bot. Gart. Berlin-Dahlem 13:686. 1937; Glassman, Fieldiana Bot. 32:102. *fig. 11.* 1969. Holotype: Brazil, Pará, Rio Maycurú, *Hübner 112* (B).

Trees 5-6 mm tall, 7 cm in diameter. Sheathing leaf base and petiole about 1 m long, margins fibrous; leaf rachis 2.0-2.36 m long, with whitish mealy indument at anthesis, pinnae 58-63 on each side, mostly in clusters of 2-4, intervals between clusters 2-5 cm, those from mid-section 60-92 cm long and 1.4-2.8 cm wide, with acute or acuminate, asymmetrical tips, with pale brown indument along abaxial midrib at anthesis, cross veinlets usually prominent adaxially. Expanded part of sterile bract 60-69 cm long and 9 cm wide, sulcate; branched part of inflorescence 50-58 cm long, rachillae averaging 9-11 in number, each 40-46 cm long. Staminate flowers 15-19 mm long on proximal part of rachilla, 10-15 mm long on distal part, sepals less than 1 mm long, petals 5.5 mm wide, anthers 5-7 mm long; pistillate flowers pyramidal, 7-11 mm long and 5-8 mm in diameter, sepals and petals more or less equal at anthesis, ovary tomentose. Mature (?) fruit ovoid, 3.5-5.8 cm long and 1.5-3.5 cm in diameter, beak 4-8 mm long, endocarp bony, about 2 mm thick along sides, 6-10 mm thick at apex and about 4 mm thick at base, cavity trivittate, smooth. Seed 2.0-2.8 cm long and 1.4-2.2 cm in diameter.

Specimens examined. **Brazil.** PARÁ: Rio Negro ad Almeirim, *Martius s.n.* (M, lectotype of *S. cocoides*); Rio Maycurú, *Hübner 112* (B, holotype

of *Syagrus brachyrhyncha*); plateau between Tapajos and Xingu, 1931, *Krukoff 1221* (F); Faro (Rio Yamanda), 1907, *Ducke 8348* (FI, MG); Bôa Vista on Tapajos R., 1929, *Dahlgren & Sella 138* (F); Cachimbo, 1955, *Werner Bockerman 240* (SP-69908); Cachoeira do Curua, Cerro de Cachimbo, Santarem-Cuiaba Hwy. BT 163, rocky white sandy area, 1977, *M. J. Balick, G. T. Prance, A. S. Silva, C. C. Berg, A. J. Henderson, B. W. Nelson, R. P. Bahia, & M. R. dos Santos 912* (F); Rio Jari, Monte Dourado, mata alta, *E. de Oliveira 3590, 3885, 4463* (NY). AMAPÁ: Rio Oiapoque, 1 km S of Pedra Alice, 1960, *H. S. Irwin, J. M. Pires, & L. Y. Westra 47632* (NY). GOIAS: Sertão d'Amaroleite, 1844, *Weddell 2690* (P, holotype of *Cocos weddellii; F, isotype*); Rio dos Indios, 1898, *Glaziou 22264a* (P); Gurupi, gallery forest, 1963, *G. & L. Eiten 5562* (CHI). MARANHÃO: *Dahlgren s.n.* (F-612366); Island of São Luiz, 1930, *R. Froes 11622* (A, F). PIAUI: between Campo Major and Therezina, 1935, *Dahlgren s.n.* (F-620827); Carolina, "chapada" woodland, 1963, *G. & L. Eiten 5490* (CHI). CEARÁ: Fortaleza, 1935, *Dahlgren s.n.* (F-620753). BAHIA: Estrada do Bom Gosto a Olivença, 1943, *R. Froes 20094* (NY). **Guyana.** Shuurutirer, Forest Dept. of British Guiana *7575* (BH).

CULTIVATED. **Brazil.** Belém, Hort. Bot. Mus. Goeldi, *Baker 9357* (MG), *Cavalcante 991* (F, MG), *Dahlgren s.n.* (F-620809), *J. Huber 9357* (FI); AMAZONAS: Quinta de São Christovão, *Glaziou 10116* (P).

Flowering from March to September.

Vernacular names: jatá-uba, cunham-hen, piririma, uaperima, pati.

Distribution: Native to Brazil, states of Pará, Amapá, Maranhão, Bahia, Piaui, Ceará, and Goias; Guyana. Wet forests, woodlands, occasionally in cerrados.

As stated earlier, *S. cocoides* was the first taxon described in genus *Syagrus* and hence is the type species. Since Martius (1826) did not cite any specimens, his collection (two sheets) from Munich was chosen as lectotype. He listed the following locality data for this palm: "sylvatica in ripa fluvii Amazonum ejusque confl. Canuma, Maue, vel campestris in ads. montis arenarii Serra de Paru dicti, et per amoena prata ad Almeirim sparsa."

I discussed the synonyms, *C. weddellii, C. drudei,* and *S. brachyrhyncha,* in earlier articles (Glassman, 1968b, 1969).

Syagrus cocoides seems to be most closely related to *S. loefgrenii* and *S. cardenasii,* morphologically and anatomically. This relationship is not evident in the key, however, because the latter two are trunkless palms. All three taxa have uncommon adaxial nonvascular fibers (NVF), but

in the trunkless species abaxial NVF are absent and in *S. cocoides* they are uncommon. *Syagrus cocoides* also seems to be allied to *S. orinocensis,* which will be discussed under that species.

15. Syagrus orinocensis (Spruce) Burret, Notizbl. Bot. Gart. Berlin-Dahlem 13:695. 1937; Glassman, Fieldiana Bot. 31:288. *figs. 4-5.* 1968; 32:91. *figs. 8-10.* 1969.

PLATE III, 7; MAP 5.

Cocos orinocensis Spruce, Jour. Linn. Soc. Bot. 11:161. 1871. Lectotype: Colombia, in rupibus secus Mayapures, *Spruce 49* (K).

S. stenopetala Burret, Notizbl. Bot. Gart. Berlin-Dahlem 11:322. 1932. Holotype: Venezuela, Dist. Federal, Puerto La Cruz, *A. Jahn 1208* (VEN).

S. allenii Glassman, Fieldiana Bot. 31:285. *figs. 1-3.* 1968. Holotype: Colombia, Meta, llanos de San Martin, *P. Allen 3352* (MO).

Trees 8-12 m tall (18 m—fide Spruce), 15 cm in diameter. Sheathing leaf base 38-41 cm long and 31 cm wide, brown tomentose externally; petiole 70-74 cm long, margins fibrous; leaf rachis 150-187 cm long; pinnae 100-107 on each side, mostly in clusters of 2-3, with prominent cross-veinlets adaxially, with pubescence streaked with reddish-brown along adaxial midrib, those from mid-section 50-56 cm long and 2.0-3.4 cm wide, with acuminate, asymmetrical tips. Expanded part of sterile bract 58-62 cm long and 8-9 cm wide, sulcate; branched part of inflorescence 38-42 cm long, rachillae usually with patches of pale indument, 40-60 or more in number, each 30-45 cm long. Proximal staminate flowers 10-12 mm long, distal ones 7-10 mm long, petals about 3 mm wide, more or less nerved, with conspicuous reddish punctate glands, anthers 5-6 mm long; pistillate flowers pyramidal, 5-9 mm long and 4-7 mm in diameter, sepals shorter than petals at anthesis and sometimes with minute red-brown scales along margins, ovary tomentose. Fruit obovoid or ovoid, 2.5-3.4 cm long and 2.2 cm in diameter, with short beak up to 3 mm long (immature—3.4-3.7 cm long and 1.3-1.5 cm in diameter, beak up to 8 mm long), endocarp cavity mostly regular in outline, trivittate, endocarp 1-2 mm thick along sides, 2.5-4 mm thick at extremities. Seed 1.6-1.9 cm long and 1.2-1.4 mm in diameter.

Specimens examined. **Colombia.** AMAZONAS: in rupibus secus Mayapures, 1854, *Spruce 49* (K, lectotype of *Cocos orinocensis*). META: junction of Guejar and Zanza rivers, 1950, *S. G. Smith & J. M. Idrobo 1460* (BH, COL, GH, US); llanos de San Martin, 1945, *P. Allen 3352* (MO, holotype of *S. allenii*; BH, isotype). VAUPÉS: Rio Cuduyari, 1944, *P. Allen 3277* (MO, BH). **Venezuela.** DISTRITO FEDERAL: Puerto La Cruz, 500 m alt., 1923, *A. Jahn 1208* (VEN, holotype of *S. stenopetala*; BH [photo], US). CARABOBO: Puerto Cabello, 1916, *J. N. Rose 22007* (GH); 1970, *Steyermark 102432* (VEN); selvas de Guaremales, 1920, *Pittier 9154* (G, GH, NY, US, VEN); near El Cambur, 1968, *J. G. Wessels Boer 2449* (CHI). BOLIVAR: Piedra Marimare, east bank of Rio Orinoco, 1955, *Wurdack & Monachino 40852* (BH, NY). AMAZONAS: Sanariapo, 1942, *L. Williams 16019* (F); Puerto Ayacucho, 1940, *L. Williams 13138* (F, VEN); same locality, 1967, *J. G. Wessels Boer 1873* (CHI); Yaracuy, near Nirgua, 1967, *J. G. Wessels Boer 2045* (CHI).

Flowering from April to December.

Vernacular names: cococito, coquito.

Distribution: Colombia and Venezuela. Wet forests or woodlands, granitic rock outcrops.

No specimens were cited by Spruce in his original article; hence the above collection of Spruce was chosen as the lectotype. Reasons for reducing *S. stenopetala* to synonymy were discussed in Glassman (1969). H. E. Moore (personal correspondence) has suggested that populations from localities where *S. stenopetala* was collected, especially in Carabobo, may represent a distinct taxon. Apparent differences in staminate flowers, size of inflorescences, indument of lower leaf surfaces, habit and habitat, and a disjunct distribution with *S. orinocensis* populations from Bolivar and Colombia warrant further investigation.

In the morphological key, *S. orinocensis* and *S. cocoides* occur in the same couplet and thus appear to be related to each other, but the former more closely resembles *S. inajai* than *S. cocoides* in its leaf anatomy pattern.

According to Braun (1968), *S. orinocensis* is abundant throughout the Mayapures River basin in the Amazon region. It is extremely resistant to drought and can grow in rocky crevices of granite massifs. During the dry season, plants are often exposed to hot winds for long periods, but they initiate flowers and fruits before the rainy season begins in May. This palm is rarely cultivated because the delicate root system is frequently damaged when seedlings are transplanted.

16. Syagrus glaucescens Glaz. *ex* Becc., Agric. Colon. 10:466. 1916; Dahlgren, Index Amer. Palms *pl. 387.* 1959; Glassman, Fieldiana Bot. 31:293. *figs. 10-11.* 1968.

FIG. 8; PLATE II, 4; MAP 3

Holotype: Brazil, Minas Gerais, Biribiry, *Glaziou 20024* (FI).

Trees about 4.5 m tall, 8-10 cm in diameter. Sheathing leaf base and petiole combined about 31 cm long, petiole margins fibrous; leaf rachis 55-60 cm or more long, pinnae 38-40 on each side, mostly in clusters of 3-4, glaucous on both surfaces, becoming green with age, those from mid-section 30-34 cm long and 2.5 cm wide, mostly with acute or obtuse, asymmetrical tips. Expanded part of sterile bract 35-40 cm long and 8 cm wide, sulcate; branched part of inflorescence 25-29 cm long, peduncle about 45 cm long, rachillae 15-17 in number, each 12-19 cm long. Staminate flowers 15-17 mm long on proximal part and 8-12 mm long on distal part, petals 3-3.5 mm wide, anthers 5 mm long; pistillate flowers pyramidal, either 17-18 or 20-23 mm long, sepals longer than petals at anthesis. Fruit turbinate, about 3.5 cm long and 3 cm in diameter, short beaked, endocarp woody, 2-3 mm thick along sides, 4-7 mm thick at extremities, cavity trivittate, smooth, persistent perianth about 2 cm long. Seed globose, about 1.2 cm long and 1.2 cm in diameter.

Specimens examined. **Brazil.** MINAS GERAIS: Biribiry, near Diamantina, 1892, *Glaziou 20024* (FI, holotype; C,F,K,P); same locality, 1965, *Glassman & Gomes 8111, 8112, 8114, 8116* (CHI, SP); Serra do Espinhaço, 23 km E of Diamantina, wet campo sujo and cerrado, 1970, *H. S. Irwin, S. F. da Fonsêca, R. Souza, R. Reis dos Santos, & J. Ramos 27605* (NY); vicinity of Mendanha, 1936, *W. A. Archer 4078* (BH, US); 1816-1821, *St. Hilaire 1232* (P); 5 km SE of Mendanha, dense cerrado, 1976, *Glassman 13002* (CHI), Santa Ana do Riacho, rochosa de morro, 1974, *Hatschbach & Ferreira 35324* (F).

Flowering from March to September.

Vernacular names: none recorded.

Distribution: Endemic to Brazil, state of Minas Gerais. Mostly in rocky cerrados and campos.

Syagrus glaucescens seems to be most closely related to *S. duartei,* a trunkless palm from Serra do Cipó, Minas Gerais. Both species have a remarkably similar leaf anatomy pattern, a sterile bract and inflorescence about the same size, clustered pinnae of approximately the same length and width with acute asymmetrical tips, and rather large pistillate flowers

17-25 mm long. Besides overall size, *S. glaucescens* differs from *S. duartei* in having more numerous rachillae (15-17 rather than 5-8) and fewer pinnae per leaf (38-40 rather than 60-64).

This palm is locally common (sometimes in pure stands) in rocky outcrops of Serra do Biribiry (in the vicinity of Diamantina and Mendanha), Serra do Gombo, and Serra do Rio Grande. It occurs mainly at higher elevations, between 700-1200 m. Other palms growing in the area, but usually at lower altitudes, are *Syagrus mendanhensis* and a species of *Allagoptera,* both trunkless.

17. Syagrus duartei Glassman, Fieldiana Bot. 31:289. *figs. 6-9.* 1968.
PLATE II, 2; MAP 3.

Holotype: Brazil, Minas Gerais, Serra do Cipó, *A. P. Duarte 5706* (RB).

Plants without emergent stem. Sheathing leaf base 18-20 cm long, deteriorating into separate marginal fibers with age; petiole 6-7 cm long and 1.5 cm wide, margins fibrous or smooth; leaf rachis 78-84 cm long; pinnae 60-64 on each side, mostly in clusters of 2-4, adaxial surface glaucous, becoming green with age, those from mid-section 32-34 cm long and 2.0-2.4 cm wide, mostly with acute, asymmetrical tips. Expanded part of sterile bract 40-45 cm long and 5 cm wide, deeply sulcate, brownish-tomentose, becoming glabrous with age; branched part of inflorescence 30-35 cm long, rachillae 5-8 in number, each 18-22 cm long. Staminate flowers 16-20 mm long on proximal part of rachilla and 10-15 mm long on distal part, sepals 3-4 mm long, petals 4-5 mm wide, anthers 6-7 mm long; pistillate flowers pyramidal, sepals longer than petals at anthesis, mostly 17-25 mm long and 6-8 mm in diameter. Fruit more or less turbinate, about 3 cm long and 3 cm in diameter, endocarp 6-8 mm thick, cavity smooth. Seed not seen.

Specimens examined. **Brazil.** MINAS GERAIS: Serra do Cipó, between blocks of quartzite, very frequent, 1961, *A. P. Duarte 5706* (RB, holotype); same locality data, 1300 m alt., 1965, *Glassman 8033-8036* (CHI).

Flowering in July and August.

Vernacular names: none recorded.

Distribution: Native to Brazil, state of Minas Gerais, apparently endemic to the Serra do Cipó region. Open quartzite outcrops at upper elevations, about 1300 m.

Syagrus duartei is probably most closely allied to *S. glaucescens*, a tree about 4 m tall, which has a strikingly similar leaf anatomy pattern, similar pistillate flowers, and pinnae about the same length and width.

According to Eiten (1972), the Serra do Cipó region has a high percentage of endemic species. Plants grow there on gray lithosol soils over quartzite rocks, characteristic of the vast Planalto region. Main vegetation types covering the area are: natural grassy meadows on level upland sites (*Syagrus pleioclada* occurs here); "rocky campo"— open campo slopes with stony soil and rock slab outcrops (*S. duartei* is found here); and dense scrub and cliffside vegetation.

18. Syagrus pleioclada Burret, Repert. Sp. Nov. 32:110. 1933; Notizbl. Bot. Gart. Berlin-Dahlem 13:683. 1937; Glassman, Fieldiana Bot. 31:298. *figs. 14-15*. 1968.

PLATE IV, 2; MAP 8.

Holotype: Brazil, Minas Gerais, Serra do Cipó, *Werdermann 3916* (B). cf. Glassman 1969, p. 101, *fig. 12*.

Plants without emergent stem, or with short trunk up to 0.5 m high. Sheathing leaf base 20-24 cm long; petiole 12-15 cm long and about 1 cm wide, with fibrous margins; leaf rachis 80-83 cm long; pinnae 23-25 on each side, in clusters of 2-3, those from mid-section 48-51 cm long and 1.5 cm wide, mostly with long acuminate, symmetrical tips, intervals of about 6-10 cm between clusters. Expanded part of sterile bract 14-18 cm long and 7-8 cm wide, sulcate, brownish-tomentose, becoming glabrous with age; branched part of inflorescence 7-9 cm long, mostly gnarled and twisted, peduncle about 16 cm long, rachillae 10-17 in number, each 1.0-3.5 cm long. Staminate flowers 7-9 mm long on proximal part of rachilla, 5-7 mm long on distal part, petals 3-4 mm wide, covered with tiny tubercles and orange punctate glands, apex fleshy, about 2 mm thick, anthers 3 mm long; pistillate flowers ovoid or rounded, 8-11 mm long and 6-8 mm in diameter, sepals shorter than petals at anthesis, petals exceptionally fleshy on distal half, about 1.50-1.75 mm thick. Fruit ovoid, 2.5-3 cm long and 2.1 cm in diameter, slightly beaked, endocarp woody, 2-3 mm thick along sides, 3-4 mm thick at extremities, cavity smooth. Seed obovate, 1.3 cm long and 1.1 cm in diameter.

Specimens examined. **Brazil.** MINAS GERAIS: Serra do Cipó, 1100-1300 m alt., in limestone rock, 1932, *Werdermann 3916* (B, holotype); 1935, *Mello Barreto & Brade 1206* (RB); 1949, *A. P. Duarte 2018* (RB);

1952, *L. B. Smith 6699* (BH, US); scrub grassland, 1965, *Glassman & Gomes 8037-8042* (CHI); *Heringer & Castellanos 6134* (SP); mun. S. Ana do Riacho, in mountain rocks, 1974, *Hatchbach 35313* (F); between Rio Parauna and As Dattas, campo, 1892, *Glaziou 20023* (K, P).

Flowering from April to December.

Vernacular names: none recorded.

Distribution: Endemic to Brazil, state of Minas Gerais, mostly confined to the Serra do Cipó region. Open rocky and level areas.

This species is distinct and can be identified by its short rachillae, which are gnarled and twisted, and widely spaced pinnae clusters (6-10 cm apart). It seems to be most closely related to *S. mendanhensis.*

Syagrus pleioclada is found in the same general locality as *S. duartei* in Serra Cipó, but it usually grows at lower elevations (between 1100-1300 m rather than above 1300 m) and on a flatter, less rocky, more grassy type of terrain. The two species are not known to grow together in the same habitat.

19. Syagrus mendanhensis Glassman, Fieldiana Bot. 31:298. *figs. 12-13.* 1968. Holotype: Brazil, Minas Gerais, Mendanha, *W. A. Archer 4086* (BH).

Plants without emergent stem. Sheathing leaf base not seen; petiole 35-37 cm long and about 1 cm wide, with fibrous margins; leaf rachis 58-70 cm long; pinnae 16-18 on each side, mostly in clusters of 2-4, intervals between clusters mostly 3-5 cm, those from mid-section 38-45 cm long and 8-10 mm wide, mostly with acuminate, symmetrical or asymmetrical tips. Expanded part of sterile bract 28-30 cm long and 3.2 cm wide, sulcate; branched part of inflorescence 21 cm long, rachillae 9 in number, each 15-16 cm long. Staminate flowers 8-10 mm long, petals 2-3 mm wide; pistillate flowers pyramidal, sepals longer than petals at anthesis, 12 mm long and 5 mm in diameter. Fruit (immature) oblong-ovoid, 3 cm long and 0.9 cm in diameter, beak about 4 mm long. Seed not seen.

Specimens examined. **Brazil.** MINAS GERAIS: vicinity of Mendanha, along road, 1936, *W. A. Archer 4086* (BH, holotype; US); 5 km SE of Mendanha, common in dense cerrado, associated with *S. glaucescens,* 1976, *Glassman 13003* (CHI).

Flowering in September.

Vernacular names: none recorded.

Distribution: Endemic to Brazil, state of Minas Gerais, mostly confined to the Mendanha area. Campos or cerrados.

This species strongly resembles *S. pleioclada*, especially in the vegetative stage, but it can be distinguished by the longer, narrower sterile bracts; the longer inflorescences with longer (15-16 cm), straight rather than short (1.5-3 cm), gnarled and twisted rachillae; and the pyramidal rather than ovoid pistillate flowers. Both taxa have a similar leaf anatomy pattern.

20. Syagrus flexuosa (Mart.) Becc., Agric. Colon. 10:466. 1916; Dahlgren, Index Amer. Palms *pl. 386*. 1959; Glassman, Fieldiana Bot. 32:81. *figs. 1-3*. 1969.

FIG. 12; PLATE II, 3; MAP 4.

Cocos flexuosa Mart., Hist. Nat. Palm. 2:120. *t. 64, 86*. 1826. Lectotype: Brazil, without definite locality, *Martius s.n.* (M). cf. Dahlgren 1959, *pl. 386* (excluding rachilla of *S. macrocarpa*).

C. flexuousa var. *cataphracta* Mart., Hist. Nat. Palm. 2:120. 1826. Type: Brazil, Bahia, Caetitê (no specimens cited).

C. flexuosa var. *densiflora* Mart., *ibid*. Type: Brazil, Bahia, Serra Fria (no specimens cited).

S. campestris (Mart.) H. Wendl., Index Palm. 17. 1854; Dahlgren, Index Amer. Palms *pl. 380*. 1959.

C. campestris Mart., Hist. Nat. Palm. 2:121. *t. 87*. 1826; Barb. Rodr., Palm. Mattogross. *t. 5-6*. 1898. Lectotype: Brazil, Minas Gerais, *Martius s.n.* (M). cf. Dahlgren 1959, *pl. 380*.

S. urbaniana (Dammer) Becc., Agric. Colon. 10:468. 1916.

C. urbaniana Dammer, Bot. Jahrb. Syst. 31:22. 1902. Lectotype: Brazil, Minas Gerais, Caraga, *Glaziou 15558* (P). cf. Dahlgren 1959, *pl. 396*.

Trees 2.0-4.5 m tall, trunks frequently caespitose. Sheathing leaf base 28-31 cm long, margins fibrous; leaf rachis 95-106 cm long, with dense or sparse covering of brownish indument; pinnae 70-79 on each side, mostly in clusters of 2-4, glaucous or becoming green on both surfaces, with brownish ramenta along abaxial midrib, those from mid-section 30-36 cm long and 0.5-1.6 cm wide, mostly with acuminate, asymmetrical tips. Expanded part of sterile bract 40-48 cm

long and 5-6 cm wide, sulcate, both glaucous and with patches of light brown indument, becoming green and glabrous with age; branched part of inflorescence 40-44 cm long, rachillae 16-18 or more in number, each 32-36 cm long, with scattered patches of pale indument. Staminate flowers 10-16 mm long on proximal part of rachilla, 5-10 mm long on distal part, petals about 2.5 mm wide, tips frequently irregular and variable in shape, anthers 3-3.5 mm long; pistillate flowers 17-22 mm long and 6-9 mm in diameter, pyramidal, sepals and petals about equal in size at anthesis, petals and sepals imbricate, or frequently with prominent valvate tips. Mature (?) fruit 3.5 cm long and 1.5-1.7 cm in diameter, beak about 6 mm long, endocarp 3-5 mm thick, cavity mostly regular in outline, trivittate, persistent perianth 1.5-2 mm long. Mature seed not seen.

Specimens examined. **Brazil.** MINAS GERAIS: without locality, *Martius s.n.* (M, lectotype of *Cocos campestris*); 1816-1821, *St. Hilaire 287, 1245* (P); 1843, *Weddell 1678* (P); Campos do Curvelo, 1839, *P. Claussen s.n.* (G); 1840, *Gardner 4028* (K); Lagoa Santa, *Warming 1846* (C), *Shamel, Popenoe, & Dorseit 234b* (US), 1965, *Glassman & Gomes 8044-8054* (CHI, SP); between Uberava and Bada, 1848, *Regnell 1288* (S); 1892, *Schwacke 8470* (RB); Ituiubata, 1944, *Macedo 496* (SP); Belo Horizonte, 1900, *Teixeira 24156* (SP); 300 km de Brasilia para Belo Horizonte, 1964, *J. M. Pires 58041* (NY); Caraca, 1884, *Glaziou 15558* (P, lectotype of *Cocos urbaniana*; C, F, FI, K, MO); between Congonhas do Campo and Queluz, 1884, *Glaziou 15559* (C, MO, NY, P, US); São João del Rey, 1887, *Glaziou 17337* (C, F, FI, K); Biribiry, 1892, *Glaziou 20026* (A, C, FI, K, NY, P); Serra de Lenheiro, 1893, *Glaziou 20536* (P); Paraopeba, 1965, *J. Elias de Paula 70* (SP); Serra do Cabral, E of Joaquin Felicio, 1970, *H. S. Irwin, S. F. da Fonsêca, R. Souza, R. Reis dos Santos, & J. Ramos 27003* (NY). SÃO PAULO: Moji-Guaçu, *G. & L. Eiten 2220* (SP); Paccas, Rio Feio, 1905, *G. Edwall 144* (SP); Tiete, 1936, *Hoehne & Gehrt 37053* (F, SP); near Marilia, 1940, *Normanha & Zagatto 5621* (SP); Mogy-Mirim, 1942, *M. Kuhlmann & P. Goncalves 47390* (F, SP); Anhembi, Fazenda Barriero Rico, 1959, *M. Kuhlmann 4541* (SP); estrada Araraquara a Baurú 286 km, 1965, *Glassman & Gomes 8002* (CHI, SP). MATO GROSSO: Rio dos Baynes, *Spencer Moore 427* (BM); Xavantina 1946, 1947, *H. Sick 57946, 59280* (RB), 1964, *H. S. Irwin & T. R. Soderstrom 6313* (BH, NY); Rio Pequire, 150 km S of Rondopolis, gallery forest, 1976, *Glassman 13088* (CHI); S. Jose de Serra, Mun. Cuiaba, cerrado, 1975, *Hatschbach 37477* (F).

GOIAS: entre Goias and Cuyaba, 1844, *Weddell 2990* (P); Valléa im Chica Costa, 1894, *Glaziou 22261* (C, F, FI, G, K, MO, P, US); Cabaceirá do Rio Gama, 1894, *Glaziou 22264* (C, K, P); margin of Serra Velha, mata ciliar, 1965, *Heringer 10475* (NY); Chapada dos Veadeiros, 1966, *H. S. Irwin, J. W. Grear, R. Souza, & R. Reis dos Santos 12766* (BH, F, NY); Mun. Cavalcante, campo alto, 1975, *Hatschbach 36872* (F). DISTRITO FEDERAL: Brasilia, Sobradinho, 1965, *Belém 493* (BH); Campus, U. of Brasilia, 1965, *Belém 466, 467* (BH); 1965, *Heringer 10408* (NY); Corrego Covancas, 22 km NE of Brasilia, 1966, *H. S. Irwin, R. Souza, & R. Reis dos Santos 11578* (BH, NY); 3 km S of Sobradinho, 1966, *H. S. Irwin, R. Souza, & R. Reis dos Santos 15458* (BH, NY); 2 km E of Lago Paranoa, 1970, *H. S. Irwin, S. F. da Fonseca, R. Souza, R. Reis dos Santos, & J. Ramos 26637* (NY); 10 km SE of Brasilia, cerrado, 1976, *Glassman &* Eiten 13051, 13053 (CHI). BAHIA: 1941, *Bondar s.n.* (F-404609); Jequié, Berra da Estiva, 1941, *Bondar s.n.* (F-620821); Veredinha, Munic. of Seabra, 290 km W of Salvador, dense caatinga, 1976, *Glassman 13039, 13040* (CHI). Without definite locality: *Martius s.n.* (M, lectotype of *Cocos flexuosa*); *Sello s.n.* (LE, P); 1840, *Gardner 4028* (K); *Glaziou s.n.* (A).

CULTIVATED. **Brazil.** Jardim Botanico, Rio de Janeiro, 1924, *L. H. Bailey & E. Z. Bailey 491* (BH).

Flowering from December to October.

Vernacular names: acumã, coqueiro do campo, palmito do campo, coco do vaqueiro.

Distribution: Native to Brazil, states of São Paulo, Minas Gerais, Goias, Bahia, and Mato Grosso. Campos, cerrados, caatingas, woodlands, disturbed habitats.

The specimen chosen as lectotype of *Cocos flexuosa* lacks locality data, but in the original publication, Martius (1826) lists the following: in fields of the state of Minas Gerais near Rio Paraopeba, between São João del Rey and Villa Rica, and near Fanado and Formigas Contendas. Martius also lists S. Lucia and S. Pedro, in Serra de Macaco and Serra Dourada mountains in the state of Goias, according to Pohl. For var. *cataphracta,* Martius lists Caetitê and for var. *densiflora,* Serra Fria, both in the state of Bahia; but, as with *Cocos flexuosa,* no specimens were cited for these varieties.

The specimen of *Cocos campestris* chosen as lectotype only shows Minas Gerais on the label, but in his original description, Martius lists

Ytu in the state of São Paulo and Minas Gerais without a specific locality.

Reasons for including *S. campestris* and *S. urbaniana* under synonymy of *S. flexuosa* and its range of morphological variation have been discussed in Glassman (1969). For *S. urbaniana,* Dammer did not indicate the herbarium in which the holotype was located. The specimen from (P) was chosen as lectotype because it was published in Dahlgren (1959) as a type. In 1969, I erroneously referred to this specimen as a holotype.

Syagrus flexuosa seems to be most closely related to *S. oleracea* because the pistillate and staminate flowers are approximately the same size and shape. The two taxa also have a similar flavonoid pattern. *Syagrus flexuosa* can be distinguished from *S. oleracea* by the smaller trunk, which is usually caespitose, the narrower pinnae, and the narrower beaked fruits. Although *S. flexuosa* and *S. petraea* are not closely allied morphologically, they may have some close chemical affinities because both have an almost identical flavonoid pattern.

This palm has a fairly wide geographic distribution in Brazil, probably because of its relatively broad ecological amplitude. It seems to be especially well adapted to disturbed habitats.

21. Syagrus oleracea (Mart.) Becc., Agric. Colon. 10:467. 1916; Glassman, Fieldiana Bot. 32:17. *figs. 1-3, 9.* 1968.

PLATE III, 6; MAPS 1, 6.

Cocos oleracea Mart., Hist. Nat. Palm. 2:117. *t. 82.* 1826. Lectotype: Brazil, Prov. Minas Gerais, Rio S. Francisco, *Martius 1595* (M). cf. Dahlgren 1959, *pls. 393-394.*

S. oleracea var. *platyphylla* (Drude) Becc., Agric. Colon. 10:467. 1916; Dahlgren, Index Amer. Palms *pl. 395.* 1959.

C. oleracea var. *platyphylla* Drude *in* Martius, Fl. Brasil. 3:417. 1881. Lectotype: Brazil, cult. Horto Publico, Rio de Janeiro, *Glaziou 8063* (C).

S. picrophylla Barb. Rodr., Prot.-Append. Enum. Palm. Nov. 45. 1879.

C. picrophylla (Barb. Rodr.) Barb. Rodr., Les Palmiers, 26. *t. 3, figs. 2a-b.* 1882; Sertum Palm. Brasil. 1: *t. 65A-66.*

1903. Lectotype: Brazil, Rio de Janeiro (Barb. Rodr., Les Palmiers 26. *t. 3, figs. 2a-b,* 1882).

S. gomesii Glassman, Fieldiana Bot. 32:22. *figs. 4-8.* 1968. Holotype: Brazil, São Paulo, 3 km N of Pompeia, *Glassman & Gomes 8005* (CHI).

Trees 3-24 m tall and up to 30 cm or more in diameter, trunk much taller (up to 36 m) and narrower (15 cm) in very old specimens. Sheathing leaf base 45-95 cm long, deteriorating into separate fibers; petiole 4-17 cm long, margins fibrous or smooth; leaf rachis 120-263 cm long; pinnae 100-152 on each side, mostly in clusters of 3-4, slightly glaucous or green on both surfaces, those from mid-section 62-88 cm long and 3.0-4.0 (4.5) cm wide, mostly with acuminate, symmetrical tips. Expanded part of sterile bract 60-100 cm long and 9-14 cm wide, sulcate; branched part of inflorescence 40-68 cm long, rachillae 27-50 or more in number, each 31-45 cm or more long. Staminate flowers 13-22 mm long on proximal part of rachilla and 10-14 mm long on distal part, petals 3 mm wide, anthers 7-9 mm long; pistillate flowers pyramidal, sepals longer than petals at anthesis, distinctly wrinkled, 17-22 mm long, 8-10 mm in diameter. Mature fruit usually greenish, ovoid, 5.0-5.5 cm long and 2.5-3 cm in diameter, beak up to 7 mm long, epicarp and mesocarp 1-2 mm thick, fibrous, endocarp woody, 5-8 mm thick along sides, 7-13 mm thick at extremities, with conspicuous clusters of fibers in *Glassman & Gomes 8003,* cavity mostly smooth, trivittate. In cultivated specimens (e.g., *Bidlingmayer s.n.*) mature ripe fruit orange, rounded 4.5 cm long and 4.5 cm in diameter, mesocarp about 7 mm thick and fleshy. Seed 1.8-2.5 cm long and 1.2-1.5 cm in diameter.

Specimens examined. **Brazil.** MINAS GERAIS: Rio S. Francisco, *Martius 1595* (M, lectotype of *Cocos oleracea*)—2 sheets; Riacho das Varas, 1892, *Glaziou 20028* (C, FI, K, P). GOIAS: southern Serra Dourada, E of Formosa, 1956, *E. Y. Dawson 15218a* (BH). BAHIA: 1941, *Bondar s.n.* (F-620824), common in caatingas, near Crato, 1839, *Gardner 1865* (K). PERNAMBUCO: Tapera, open field, 1924, *B. Pickel s.n.* (BH); Tapera, campos altos, 1926, *B. Pickel 1208* (IPA); Pombos, Capoeira, 1966, *Costa 66-0003* (IPA); Goiana, Capoeira, 1966, *Costa 66-0009* (IPA); Pombos, along stream, 1969, *Glassman & Costa 8701* (CHI); 2 km W of Neves, agreste, associated with *S. coronata* and *S.* × *costae,* 1969, *Glassman & Costa 8706* (CHI). PARAÍBA: 1935, *Luetz-*

elburg 26815 (BH). CEARÁ: 1929, *Dahlgren s.n.* (F-613592); Maraguape, 1940, *Dahlgren s.n.* (F-619724); Fortaleza region, near Mejecana, 1935, *Dahlgren s.n.* (F-620753a). PARANÁ: 2 km N of Carlopolis, 1962, *J. Mattos & H. Bilcalho 10735* (SP). SÃO PAULO: between Limeira and Moora Azul, near Rio Gelado, 1881, *Glaziou 13295* (C, F, FI, K, P); Amparo, Monte Alegre, Fazenda N.S. Encarnação, 1942, *M. Kuhlmann & E. Kuhn 1157* (F, SP); entre Morro Grande and Leme, 1943, *M. Kuhlmann 50071* (SP); 12 km E of Rio Claro, Fazenda dos Caeures, 1965, *Glassman & Gomes 8001* (CHI); 3 km N of Pompeia, Hacienda Gueivira, 1965, *Glassman & Gomes 8005* (CHI, holotype of *S. gomesii*), *8006* (CHI); 18 km E of Marilia, Fazenda Pedro Felipe, 1965, *Glassman & Gomes 8003, 8004* (CHI); 20 km N of Tupã, Fazenda Vanuir, 1965, *Glassman & Gomes 8009* (CHI). GUANABARA: Rio de Janeiro, *Glaziou 9000* (K); Sete Contas, 1887, *Glaziou 9010* (A, C, FI, K, LE, NY, P, R, S, US). ESPIRITO SANTO: Vitoria, *Bondar 15, 16* (F). **Paraguay.** Montes-Limeira, *Hassler 1233* (G).

CULTIVATED. **Brazil.** Rio de Janeiro, Horto Publico, 1875, *Glaziou 8063* (C, lectotype of *C. oleracea* var. *platyphylla*; A, NY, P, US); São Christovão, 1874, *Glaziou 7000* (C, P), *8049* (C, F, K, P); 1880, *Glaziou 12255* (C, K, LE, P); Passeio Publico, 1888, *Glaziou 17338* (C, F, FI, NY, P, US); Jardim Botanico, 1924, *L. H. Bailey & E. Z. Bailey 472, 538* (BH); Belém, Hort. Mus. Goeldi, 1940, *Dahlgren s.n.* (F-620808); 1965, *MG 38* (F, MG). **Indonesia.** *Hort. Bot. Bog. 250* (FI). **Java.** Bot. Gardens, Buitenzorg, 1936, *Furtado 31.176* (BH). **Cuba.** Atkins Garden, Soledad, 1953, *Moore 6507* (BH). **United States.** FLORIDA: Chapman Field, U.S.D.A. Plant Introd. Station, 1965, *Read 1428* (BH); Fairchild Tropical Garden, 1965, *Read 1489* (BH); cultivated from seed, Vero Beach, 1972, *W. L. Bidlingmayer s.n.* (CHI).

Flowering from January to November.

Vernacular names: coqueiro amargoso, coqueiro guariroba, guahiro, paty amargoso, catolé, coco babão.

Distribution: Native to Brazil, states of Paraná, São Paulo, Guanabara (Rio de Janeiro), Espirito Santo, Minas Gerais, Goias, Bahia, Pernambuco, Paraíba, and Ceará; Paraguay. Mainly in woodlands.

No specimens were cited by Martius in his original article; therefore, the above specimen collected from the general type locality was chosen as lectotype of *S. oleracea.*

Drude (1881) listed several specimens (*Glaziou 8063, 8049, 9010*) in his description of *Cocos oleracea* var. *platyphylla* without indicating

in which herbaria they were deposited. Therefore, I have selected *Glaziou 8063* (C) as lectotype. Dahlgren (1959, *pl. 395*) illustrated *Glaziou 6000* (C) as a type for this taxon, but, as shown above, the specimen was not among those cited by Drude.

No specimens were cited by Barbosa Rodrigues for *S. picrophylla* in any of his articles (1879, 1882, 1903a) and no specimens annotated by him could be found. Hence, one of his illustrations was chosen as lectotype.

After I described *S. gomesii* (Glassman, 1968c) as a new species (distinguished by a taller and narrower trunk, a shorter leaf rachis, fewer pinnae per leaf, and shorter pinnae than *S. oleracea*), it was suggested to me that this taxon may only be an advanced or senescent growth stage of *S. oleracea*. Subsequently in Brazil in 1969, I observed a similar phenomenon in several stands of *Polyandrococos caudescens* (Mart.) Barb. Rodr. and *Cocos nucifera* L. in Bahia and Espirito Santo. Occasional trees in certain stands were taller and narrower and had shorter crowns of leaves than most of the individuals in the stand. Dr. H. E. Moore has also informed me that the above phenomenon is characteristic of senescence in many species of palms. As other morphological and anatomical features of *S. gomesii* are similar to *S. oleracea,* I have reduced it to synonymy.

Morphologically, *S. oleracea* seems to be most closely related to *S. macrocarpa* and *S. flexuosa*. It differs from *S. macrocarpa* mainly in the smaller pistillate flowers and from *S. flexuosa* in the wider middle pinnae. The leaf anatomy pattern seems to differ with that of *S. macrocarpa* but is similar to that of *S. flexuosa*.

In the state of São Paulo, *S. oleracea* is particularly abundant in localities near Marilia, Pompeia, and Tupã. In 1965, it was observed in these areas in stands of about 200 to 3000 trees, usually sharing dominance with *Arecastrum romanzoffianum*. In at least one of these localities, the two taxa apparently hybridize to produce *S.* × *teixeiriana* Glassman, but these hybrids seem to be rare. *S. oleracea* also crosses with *S. coronata* in Pernambuco to form *S.* × *costae* Glassman. The hybrids are fairly common here, however, and apparently backcross with one or both parents.

It is not certain whether the mature fleshy fruit of *S. oleracea* is edible, but the terminal bud (palmito) has a bitter taste as the vernacular name "coqueiro amargoso" implies.

22. Syagrus macrocarpa Barb. Rodr., Prot.-Append. Enum. Palm. Nov. 46, 48. 1879; Dahlgren, Index Amer. Palms *pl. 392.* 1959.

PLATE III, 5; MAP 2.

Cocos macrocarpa (Barb. Rodr.) Barb. Rodr., Les Palmiers, 26. 1882; Sertum Palm. Brasil. 1:112. *t. 85-86.* 1903. Lectotype: Brazil, in forests of upper valley of Rio Parahyba in Rio de Janeiro (Barb. Rodr., *t. 85-86,* 1903). cf. Glassman 1972b, p. 213.

Cocos procopiana Glaz. *ex* Drude *in* Martius, Fl. Brasil. 3:412. *t. 87, fig. 2.* 1881. Lectotype: Brazil, cult. Horto Publico, Rio de Janeiro, *Glaziou 9015* (C). cf. Dahlgren 1959, *pl. 392.*

Trees 5-10 m tall, 12-20 cm in diameter (fide Drude). Complete petiole and rachis not seen; pinnae mostly in clusters of 3-4, those near mid-section 50-57 cm long and 2.5 cm wide, mostly with acuminate, symmetrical tips. Sterile bract not seen; complete inflorescence not seen, rachillae 30-34 cm long. Staminate flowers 9-14 mm long, petals 4 mm wide, anthers 5 mm long; pistillate flower scars about 1 cm in diameter; pistillate flowers pyramidal, sepals slightly longer than petals at anthesis, 27-35 mm long and 16-19 mm in diameter, ovary tomentose. Fruit 9 cm long and 4.5 cm in diameter (fide Barb. Rodr. and Drude), endocarp about 1 cm thick, cavity smooth. Seed 6 cm long and 1.5 cm in diameter (fide Barb. Rodr.).

Specimens examined. **Brazil.** GUANABARA: Larangeiras, 1877, *Glaziou 9015* (P). MINAS GERAIS: Juiz de Fora, 1867, *Glaziou 2145* (MO, P). Without locality, *Martius s.n.* (M).

CULTIVATED. **Brazil.** Rio de Janeiro, Horto Publico, *Glaziou 9015* (C, lectotype of *Cocos procopiana;* FI, G, K, LE).

Flowering from April to October.

Vernacular names: Maria Rosa, baba de boi grande, haryrob, jurua.

Distribution: Endemic to Brazil, states of Guanabara and Minas Gerais. Forests.

In his original description, Barbosa Rodrigues (1879) cites: "nas florestas do valle superior do Rio Parahyba, no Rio de Janeiro" No specimens were listed here, but in a later article (1903a) he published two illustrations of this palm (*t. 85-86*), which I have chosen as the lectotype. Drude (1881) described *C. procopiana* as a new species and

listed *S. macrocarpa* in synonymy, but both taxa are identical. He mentioned the following localities and specimens: in southern coastal Brazil and Argentina, in the valley of Rio Parahyba, near Juiz de Fora, and localities around Rio de Janeiro (*Glaziou 2143* and *9015* cult. Horto Publico, and without locality, *Sello*). No specimens from Argentina were seen nor could I locate the Sello collection.

I have been unable to find *Glaziou 2143,* but this could be a typographical error because *Glaziou 2145* (cited above) comes from Juiz de Fora, one of the localities mentioned by Drude. I have selected *Glaziou 9015* (C) as the lectotype of *Cocos procopiana* because it seems to have been the specimen Drude illustrated (1881, *t. 87*). Apparently, Drude did not see *9015* (P) because the information on the sheet (Larangeiras, April 22, 1877) is different than *9015* (from C, FI, G, K, and LE—cult. Horto Publico).

Syagrus macrocarpa is one of the most distinct species in the genus because of its unusually long pistillate flowers. It probably has no close relatives. It resembles both *S. oleracea* and *S. flexuosa* in the pyramidal shape of the pistillate flowers, but the flowers are longer (27-35 mm rather than 17-22 mm) and the leaf anatomy pattern is completely different.

Judging from the collecting dates on specimens cited above, *S. macrocarpa* is probably extinct, at least in its native habitat. I have not seen any authentic specimens collected after 1877, but Burret (1938) reported seeing two small trees near a train station between Petropolis and Juiz de Fora. During August 1976, I visited the vicinity of Juiz de Fora along highway BR040, about 50 km both north and south of the city. The only palm seen along this highway was *Arecastrum romanzoffianum,* which was very common.

23. Syagrus botryophora (Mart.) Mart., Hist. Nat. Palm. 3:292. *t. 166, figs. 3, 1-4.* 1845; Glassman, Fieldiana Bot. 31:153. *figs. 49-50.* 1965.

FIGS. 1, 7; PLATE I, 2; MAP 2.

Cocos botryophora Mart., Hist. Nat. Palm. 2:118. *t. 83-84.* 1826; Palmet. Orbign. 98. *t. 4, fig. 3; t. 30D, figs. 1-2, 4-11.* 1844; Bondar, Bol. Inst. Centr. Fomento Econ. Bahia 9:38. 1941; Palm. Brasil. 67. *fig. 11.* 1964.

Arecastrum romanzoffianum var. *botryophorum* (Mart.) Becc.,

Agric. Colon. 10:456. 1916. Lectotype: Brazil, Bahia, *Martius s.n.* (M). cf. Glassman 1972b, p. 88.

Trees 15-18 m tall, 15-25 cm in diameter. Sheathing leaf base 30-32 cm long; petiole 77 cm long and 10 cm wide (incomplete), margins fibrous; leaf rachis 280-295 cm long; pinnae 76-80 on each side, regularly arranged, mostly green on both surfaces, those from midsection 58-62 cm long and 2.8 cm wide, mostly with acute, asymmetrical tips. Expanded part of sterile bract 60-66 cm long and 28-33 cm wide, sulcate, acuminate tip about 5 cm long, glabrous for the most part; rachis about 50 cm long, rachillae numerous, each 28-34 cm long. Staminate flowers 10-13 mm long on proximal part of rachilla and 7-9 mm long on distal part, petals more or less evenly fleshy, about 2.5 mm wide and 0.5 mm thick, anthers about 3.5 mm long, sepals equal in size, about 1.5 mm long; pistillate flowers rounded, 5-7 mm long and 5-7 mm in diameter, sepals longer than petals at anthesis; fruiting rachis about 66 cm long, rachillae 40-44 cm long. Fruit ovoid, short beaked, 3.6-4.5 cm long and 2.2-2.5 cm in diameter, endocarp 1.5-2.0 thick along sides, about 4 mm thick at apex, cavity trivittate within, smooth. Seed ovoid, about 2 cm long and 1.5 cm in diameter.

Specimens examined. **Brazil.** BAHIA: *Martius s.n.* (M, lectotype); Ilheus, 1835, *Blanchet 100J* (G); 1940, *Bondar s.n.* (F-619734, 619760, 619764); Agua Fria, Colonia de Gangugy, 1919, *Curran 14* (GH); without locality, *Glaziou 17854* (FI); 8 km W of Lage, secondary forest, 1969, *Glassman & Costa 8724* (CHI).

Flowering in November and December.

Vernacular names: pati, patioba.

Distribution: Native to Brazil, state of Bahia. Mostly in woodland areas formerly occupied by Atlantic coastal forest vegetation.

Martius (1826) described this palm as a beautiful, woodland species growing not far from the ocean in the province of Bahia, near Rio Peraguaçu, Eugenho da Ponte, Caxoeira, Camamu, and Rio das Contas. No specimens were cited; hence I have selected a Martius specimen consisting of two leaf parts as the lectotype.

In 1844, Martius also listed this species from Bolivia (D'Orbigny), but I have not seen any authentic specimens from there. He probably confused the identity with *Arecastrum romanzoffianum.* In Martius, 1844, *t. 30D, fig. 3,* part of a leaf is illustrated showing pinnae with distinct

clusters. This illustration is incorrect because an earlier illustration (Martius, 1826, *t. 83*) and the lectotype show leaves with regularly arranged pinnae. Perhaps the illustration in Martius, 1844 misled Beccari (1916) into transferring *S. botryophora* to *A. romanzoffianum.*

In previous papers (Glassman, 1965, 1968b), I discussed reasons for maintaining *S. botryophora* as a distinct species. Besides having regularly arranged pinnae, the endocarp cavity is regular rather than irregular in outline, and the seed is smooth and ovoid rather than gibbous-uncinate. The pistillate flowers resemble those of *A. romanzoffianum* because they are both about the same size and shape, but the similarity may be superficial because several species of *Syagrus* (e.g., *S. harleyi, S. comosa, S. acaulis,* and *S. vagans*) have round or ovoid flowers 4-7 mm in length and diameter. Furthermore, in *A. romanzoffianum* the ovary is tomentose, but glabrous in *S. botryophora.* Therefore, it seems that *S. botryophora* does not have close relatives within the *Syagrus* unit.

Figure 11 of Bondar (1964), illustrating three trees growing in a disturbed or cultivated area in Bahia, is probably not typical of the way this palm usually grows. The tall, narrow trunks and relatively short crowns of leaves seem to indicate that these specimens are some of the old trees remaining from a larger stand that was cut down. The occurrence of individuals with tall, narrow trunks and short crowns of leaves (which is a phenomenon of aging) has been observed in other species of *Syagrus* (*S. oleracea* and *S. sancona*) and is discussed in more detail under these taxa.

24. Syagrus comosa (Mart.) Mart., Palmet. Orbign. 134. 1844; Hist. Nat. Palm. 3:292. 1845.

PLATE I, 7; MAP 2.

Cocos comosa Mart., Hist. Nat. Palm. 2:122. *t. 88, figs. 1-2.* 1826; Barb. Rodr., Palm. Mattogross. 22. *t. 7.* 1898; Sertum Palm. Brasil. 1:103. *t. 64B.* 1903; Lindman, Bih. Kongl. Svenska. Vetensk.-Akad. Handl. 26(3): *t. 5.* 1900. Lectotype: Brazil, Prov. Goias, *Martius s.n.* (M). cf. Dahlgren 1959, *pl. 382.*

Trees 2-7 m tall, 6-10 cm in diameter, occasionally flowering when acaulescent, sometimes caespitose. Complete sheathing leaf base and petiole not seen, brownish-tomentose, margins fibrous or smooth; leaf

rachis 110-113 cm long, covered with brownish indument; pinnae 78-82 on each side, mostly in clusters of 2-4, those from mid-section 38-44 cm long and 3.0-3.2 cm wide, mostly with acute, asymmetrical tips, scattered pale patches of indument adaxially, brownish indument along abaxial midrib, becoming glabrous with age, cross veinlets more or less prominent adaxially. Expanded part of sterile bract 68-72 cm long and 6.5-7.5 cm wide, sulcate, brownish-tomentose, becoming glabrous with age; branched part of inflorescence 28-32 cm long, peduncle 29 cm long, rachillae 17-19 in number, each 20-26 cm long. Staminate flowers more or less obovate, 10-13 mm long on proximal part of rachilla and 6-10 mm long on distal part, petals about 4.5 mm wide, with tiny orange punctate glands, especially fleshy at tip which is about 2 mm thick, anthers 3 mm long; pistillate flowers rounded, sepals and petals about same size at anthesis, more or less wrinkled, 6-7 mm long and 6-7 mm in diameter. Fruit 2.5-3.0 cm long and 1.5-1.7 cm in diameter, endocarp about 2 mm thick, persistent perianth 5-7 mm high, staminodial ring prominent, 5 mm high and about 7 mm in diameter. Seed not seen.

Specimens examined. **Brazil.** MINAS GERAIS: campis versus Paranan, *Martius s.n.* (M). GOIAS: *Martius s.n.* (M, lectotype); 1816-1821, *St. Hilaire 867* (P); entre Vista Alegna and Barro Vermelho, 1894, *Glaziou 22263* (C, F, K, MO, P, US); region of S. Serra Dourada, 1965, *E. Y. Dawson 15521* (BH); Serra dos Cristais, 8 km S of Cristalina, cerrado, 1966, *H. S. Irwin, J. W. Grear, R. Souza, & R. Reis dos Santos 13655* (GH, NY). MATO GROSSO: Serra da Chapada, 1894, *Lindman A2699* (S); 1 km NE of Garapu, 1964, *H. S. Irwin & T. R. Soderstrom 6525* (BH, NY); Serra do Roncador, 60 km N of Xavantina, cerrado, 1966, *H. S. Irwin, J. W. Grear, R. Souza, & R. Reis dos Santos 15965* (BH, NY); 8 km NE of base camp (12°54′S, 51°52′W), grassy cerrado with scattered trees to 6 m tall, sandy soil, 1968, *J. A. Rattar, J. Berholda, R. A. de Castro, R. R. de Santos, & R. Souza R919* (UB); 2.5 km SE of base camp (12°49′S, 51°46′W), cerrado, 1968, *R. M. Harley, R. Souza, & A. Fereira 10398* (UB). MARANHÃO: São Luiz, 1958, *W. A. Egler 739* (MG). PIAUI: 1839, *Gardner 2754* (K). BAHIA: 110 km SW of Barreiras, cerrado, scattered, associated with acaulescent *Attalea,* 1976, *Glassman 13049, 13050* (CHI); BA-046, 10 km W of Tartatuga, caatinga, 1977, *Hatschbach 42462* (F).

DOUBTFUL. PARÁ: Cachimbo, 1955, *Werner Bockerman 243* (SP). BAHIA: Machado Portello, *J. N. Rose & P. G. Russell 19939* (NY);

GOIAS: Munic. de Gurupe, 1963, *G. & L. Eiten 5505* (CHI). MARANHÃO: Munic. de Loreto, 1963, *G. & L. Eiten 5456* (CHI).

Flowering from June to April.

Vernacular names: guariroba do campo, palmito amargoso, babão, catolé, jeriva, pati.

Distribution: Native to Brazil, states of Minas Gerais, Goias, Mato Grosso, Maranhão, Piaui, Bahia, and Pará (?). Mostly in woodlands and cerrados, rarely in caatingas.

In his orginial publication, Martius (1826) listed: "Along Rio S. Francisco, Minas Gerais, toward province of Goyaz. Sete Lagoas near Rio das Pedras, and in the foothills of Serra do Vão de Paranan; flowers collected and sent by St. Hilaire." He cited no specimens in that or subsequent publications (1844, 1845). I have seen two collections of Martius (both leaf material) from Goias and Minas Gerais. As the type locality is not specific, I have chosen the Goias specimen as the lectotype because a photograph of it was published in Dahlgren (1959, *pl. 392*).

Apparently, *S. comosa* has no close relatives in *Syagrus,* but it may be allied to *Arecastrum romanzoffianum* because both have small, rounded pistillate flowers (4.5-7.0 mm long), fruits approximately the same size and shape, and clustered pinnae about the same width (2-3 cm). The latter taxon, however, can be distinguished from *S. comosa* by the irregular endocarp cavity and gibbous-uncinate seed. *S. comosa* may also be related to *S. botryophora* because of the similarity of pistillate flowers and leaf anatomy patterns; however, the middle pinnae are regularly arranged in *S. botryophora* and clustered in *S. comosa.*

Specimens cited above as "Doubtful" mostly lack flowers for positive identification.

25. Syagrus campylospatha (Barb. Rodr.) Becc., Agric. Colon. 10:465. 1916; Glassman, Fieldiana Bot. 31:366. *figs. 1,3.* 1968.

PLATE I, 4; MAP 5.

Cocos campylospatha Barb. Rodr., Palm. Hassler. Nov. 9. 1900; Sertum Palm. Brasil. 1: *t. 73, fig. A.* 1903. Holotype: Paraguay, in campis Cordillera de Altos, *Hassler 1733* (G).

S. apaensis (Barb. Rodr.) Becc., Agric. Colon. 10:465. 1916.

C. apaensis Barb. Rodr., Bull. Herb. Boissier 2(3):625. 1903;

Sertum Palm. Brasil. 1:100. *t. 74, fig. A.* 1903. Holotype: Paraguay, Arroyo Trementino, region of Rio Apa, *Hassler 7688* (G).

C. acaulis ssp. *glauca* Drude *ex* Lindman, Bih. Kongl. Svenska. Vetensk.-Akad. Handl. 26(3):23. 1900. Holotype: Paraguay, Paraguari, in campo aprisco arenoso, *Regnell A1879* (S).

S. hassleriana (Barb. Rodr.) Becc., Agric. Colon. 10:466. 1916.

C. hassleriana Barb. Rodr., Sertum Palm. Brasil. 1:101. *t. 74, fig. B.* 1903. Holotype: Paraguay, in arenosis prope Concepcion, *Hassler 7164* (G).

Plants without emergent stem. Sheathing leaf base 17-20 cm long; petiole 16-19 cm long and 0.7 cm wide, with fibrous margins; leaf rachis 65-70 cm long; pinnae 34-38 on each side, in clusters of 2, those from mid-section 24-38 cm long and 0.7-1.1 cm wide, mostly with acute, asymmetrical tips, adaxial surface mostly appressed white-brownish pubescent, abaxial surface mostly glaucous. Expanded part of sterile bract 35-37 cm long and 4-6 cm wide, deeply sulcate; branched part of inflorescence 20-25 cm long, rachillae 18-20 in number, each 10-15 cm long. Staminate flowers 7-8 mm long on proximal part and 5-6 mm long on distal part, petals about 2 mm wide, anthers about 3 mm long; pistillate flowers pyramidal, 6-8 mm long and 4-6 mm in diameter, sepals distinctly nerved, longer than petals at anthesis. Fruit (immature?) 2 cm long and 1.2 cm in diameter. Seed not seen.

Specimens examined. **Paraguay.** In campis Cordillera de Altos, *Hassler 1733* (G, holotype of *Cocos campylospatha;* K, NY, P, G); Plaine de Pirayu, campos, 1877, *Balansa 2711* (P); Arroyo Trementino, in region of Rio Apa, *Hassler 7688* (G, holotype of *Cocos apaensis*); Paraguari, in campo aprisco arenoso, 1893, *Regnell A1879* (S, holotype of *Cocos acaulis* ssp. *glauca*); in arenosis prope Concepcion, *Hassler 7164* (G, holotype of *Cocos hasslerana*).

DOUBTFUL. **Paraguay.** 1914, *Chodat s.n.* (G); Cordilleras de Altos, 1904, *Hassler 2163* (G); near Valenzuela, 1882, *Balansa 4776* (P).

Flowering from June to December.

Vernacular names: yatai-mi, yatay pequeño.

Distribution: Endemic to Paraguay. Mostly in grasslands with sandy soil.

Reasons for including *S. apaenis* and *Cocos acaulis* ssp. *glauca* under *S. campylospatha* have been discussed in another paper (Glassman, 1968b). Concerning *Cocos acaulis* ssp. *glauca, Regnell A1879* (S) is considered to be the holotype even though no specimens were cited by Lindman in his original article. The above collection was apparently determined by Drude to be a new subspecies. No other specimens with this inscription have been found. *Syagrus hassleriana* was thought to be a separate taxon because of its longer pistillate flowers (10-11 mm rather than 6-8 mm) and longer pinnae (38 cm rather than 24 cm). Closer inspection of the holotype reveals that the pistillate flowers have set fruit and the adaxial surface of the pinnae is appressed white-brownish pubescent, the same characteristic found in *S. campylospatha.*

Chodat s.n. and *Hassler 2163* are listed as doubtful specimens because neither have leaves, but the flowering and fruiting material are very close to this species; *Balansa 4776* lacks pistillate flowers and has a depauperate inflorescence.

Syagrus campylospatha does not appear to have close relatives but may be distantly related to *S. graminifolia* and *S. lilliputiana* because of a similar leaf anatomy pattern in the lamina. The midrib, however, is quite distinct. Apparently, this palm has not been collected since the early 1900's. It may still grow in Paraguay, however, because it is known from several different localities.

26. Syagrus sancona H. Karsten, Linnaea 28:247. 1857; Fl. Columb. 2:147. *t. 177.* 1866; Burret, Notizbl. Bot. Gart. Berlin-Dahlem 13:688. 1937; Glassman, Fieldiana Bot. 32:88. *figs. 4-7.* 1969.

PLATE IV, 4; MAP 7.

Cocos sancona (H. Karsten) Hooker, Kew Report 1882:72. 1884. Lectotype: Columbia, Cundinamarca, Guaduas (Bogotá), *Karsten s.n.* (LE). cf. Glassman 1969, *fig. 4.*

Syagrus tessmannii Burret, Repert. Sp. Nov. 32:106. 1933. Holotype: Peru Middle Marañon, near Apaga 1924 *Tessmann 4811* (B).

S. ecuadorensis Becc., Agric. Colon. 10:469 1916. Holotype: Ecuador, Zapullo, *Eggers 15681* (M).

Trees 10-20 m tall, 30-35 cm in diameter. Sheathing leaf base 75-79 cm long; petiole 58-64 cm long and 12 cm wide, margins fibrous;

leaf rachis 230-255 cm long (310 cm—fide Burret); pinnae 150-163 on each side, mostly in clusters of 2-4, those from mid-section 56-100 cm long and 3.5-4.7 cm wide, mostly with acuminate, symmetrical tips, cross veinlets prominent adaxially. Expanded part of sterile bract 100-122 cm long and 21-28 cm wide, sulcate; branched part of inflorescence (with both pistillate and staminate flowers) 70-76 cm long, rachillae 130-138 in number, each 50-58 cm long. Staminate flowers 9-12 mm long on proximal part of rachilla and 6-11 mm long on distal part, petals wrinkled, about 3 mm wide, somewhat fleshy at apex, anthers about 5 mm long; pistillate flowers ovoid at anthesis, sepals with obtuse tips, longer and lighter in color than petals, petals with acute tips, both sepals and petals conspicuously wrinkled, with orange punctate dots, 5-9 mm long and 4-7 mm in diameter, staminate inflorescence (incomplete) about 30 cm long, rachillae about 25 or more in number, each about 45 cm long, staminate flowers 8-12 mm long; branched part of infructescence 100-109 cm long, rachillae 60-63 cm long. Fruit 3.0-3.4 cm long and 1.5-2 cm in diameter, short beak, endocarp cavity mostly regular in outline, endocarp 1.5-2 mm thick. Seed 1.5-1.7 cm long and 0.8-1.0 cm in diameter.

Specimens examined. **Colombia.** CUNDINAMARCA: Guaduas (Bogotá), *Karsten s.n.* (LE, lectotype of *S. sancona*); VALLE DEL CAUCA: between Piedra de Moler and Alto del Dinde, 1946, *Cuatrecasas 22971* (COL, F, MO); Rio Guapaya, Sierra de la Macrena, dense humid forest, 1949, *Philipson, Idrobo, & Fernandez 1656* (COL, BM). **Peru.** Middle Marañon, near Apaga, 1924, *Tessmann 4811* (B, holotype of *S. tessmannii*—3 sheets; G). LORETO: Prov. Coronel Portillo, Buenos Aires, in pasture, 1960, *Moore, Salazar, & Smith 8403* (BH); Yarinacocha, 1960, *Moore, Salazar, & Smith 8408* (BH). SAN MARTIN: 8 km N of road from Tarapoto to Shapaja, dry woods, 1960, *Moore, Salazar, & Smith 8537* (BH). **Venezuela.** BOLIVAR: Cerro Pichacho, 1961, *Steyermark 88913* (BH, NY, VEN). BARINAS: Socopo, rain forest along Hwy. 5, 1966, *Steyermark & Rabe 96519* (BH, NY, US, VEN); near Barrancas, secondary forest, 1967, *J. G. Wessels Boer 1762* (CHI). **Ecuador.** Zapullo, 1897, *Eggers 15681* (M, holotype of *S. ecuadorensis.* B, K, P, US).

CULTIVATED. **Guyana.** 1899, *Jenman 7576* (K); Georgetown Botanic Gardens, 1922, *Dahlgren s.n.* (F-610660, 610698). **Trinidad.** Port of Spain, Victoria Square, 1931, *Broadway 7909* (K). DOUBT-

FUL. **Colombia.** N of Santander, Petrolea, 1946, *M. B. & R. Foster 1787* (A, BH—no flowers).

Flowering from January to November.

Vernacular names: mapora, zancona (Venezuela); palma sancona, chonta, palma real (Colombia); inchavi (Peru).

Distribution: Colombia, Peru, Venezuela, and Ecuador. Fairly common in rain forests; occasionally persisting in secondary forests, woodlands, and pastures. According to H. E. Moore (1977), this palm once was abundant on slopes bounding the Cauca Valley in Colombia at elevations from 900-1200 m. Today, the last remnants of forest where it grows are being cut. Occasionally, some trees are left when forest is felled and persist in pastures but apparently do not reproduce there.

No specimens were mentioned by Karsten in his articles of 1857 and 1866; therefore, the above cited specimen collected by Karsten was chosen as lectotype. Even though Bogotá is written on the label of this specimen, *S. sancona* probably did not grow in that region because the elevation there is higher than in the areas where this palm is known to grow.

The morphological limits of this species and the exclusion of *Oreodoxa sancona* H.B.K., *Syagrus sancona* (H.B.K.) H. Karsten, *Oenocarpus sancona* (H.B.K.) Sprengel, and *Oenocarpus iriartoides* Triana as synonyms of *S. sancona* H. Karsten have been discussed in Glassman (1969). Since the 1969 paper was published, I discovered that Burret (1937) was the first to point out Dahlgren's (1936) error in assuming that *Oreodoxa sancona* H.B.K. was the basionym for *S. sancona* H. Karsten. When Burret wrote the article, he apparently did not see Karsten's collection of *S. sancona,* which is cited above as lectotype. Description, common name, and locality indicate that *Oreodoxa sancona* H.B.K. is the same as *Syagrus sancona* H. Karsten, even if not the basionym.

Cuatrecasas 22971 (F) from Colombia has relatively short middle pinnae (56 cm long), whereas in other specimens the pinnae are up to 100 cm long. In 1958, Cuatrecasas published a photo (of *S. sancona*) of several tall trees with narrow trunks and short leaves. Leaves of *Cuatrecasas 22971* appear to have been collected from a tree similar to those in the above illustration, which probably represent the oldest ones in the stand. This morphological phenomenon has been discussed in connection with *S. gomesii* under *S. oleracea* and with regard to *S. botryophora.*

Syagrus sancona is one of the most distinct species in the genus and

has no apparent close relatives. The combination of pistillate flowers with strongly wrinkled and obtuse tipped sepals and an anatomical pattern of narrow horizontal clusters of adaxial nonvascular fibers is unique in *Syagrus*.

27. Syagrus stratincola Wessels Boer, Indig. Palms Suriname 170. *fig. 10.* 1965.

PLATE IV, 5; MAP 5.

Holotype: Surinam, Paloemeu River, *J. G. Wessels Boer 1303* (U).

Trees up to 14 m tall, about 8 cm in diameter, trunks usually caespitose. Sheathing leaf base about 30 cm long; petiole 1.5 m long, with fibrous margins; leaf rachis 2.1-2.4 m long; 80-82 pinnae on each side, in clusters of 3-4, mostly yellow green on both sides, those from mid-section 60-70 cm long and 3 cm wide, mostly with acute, asymmetrical tips. Sterile bract about 100 cm long, sulcate; branched part of inflorescence 48 cm long, rachillae 13-15 in number, each 20-26 cm long. Staminate flowers 17-19 mm long on proximal part of rachilla, 14-15 mm long on distal part, petals 5-6 mm wide, with conspicuous patches of white indument, anthers 6 mm long; pistillate flowers pyramidal at anthesis, sepals longer than petals, more or less nerved, with conspicuous patches of white ramenta, 16-20 mm long and 6-7 mm in diameter. Mature fruit more or less round, 4 cm long and 3.7-4 cm in diameter, not beaked, epicarp irregularly striate, fibrous, endocarp bony, 1.5-2.0 mm thick along sides and at base, 5 mm thick at apex, cavity trivittate, rounded and smooth. Seed 2.2 cm long and 2.2 cm in diameter.

Specimens examined. **Surinam.** Paloemeu R., near confluence with Tapanahoni R, on shaded wet granite outcrops in mesophytic forest, 1963, *J. G. Wessels Boer 1303* (U, holotype; BH, F, isotypes); *Versteeg 805* (U). **Guyana.** Base of Roosevelt Peak, 140 m alt., in patches of vegetation on granitic knobs, 1977, *Moore, Ilimawale, Parthasarathy, Schoen, & van Slobbe 10329* (BH).

Flowering in April and July.

Vernacular names: akanauwirie (Trio); pali (Guyana).

Distribution: Native to Surinam, on granite outcrops in mesophytic forests. Guyana, on granite outcrops exposed to full sun.

Syagrus stratincola is an unusual species within the genus mainly

because of its subglobose fruit and striated epicarp. It may be remotely allied to *S. cocoides* and *S. orinocensis,* but it probably has no close relatives.

28. Syagrus coronata (Mart.) Becc., Agric. Colon. 10:466. 1916; Dahlgren, Index Amer. Palms *pls. 383-384.* 1959, Glassman, Fieldiana Bot 31:385, 390. *figs. 11, 15.* 1968.

PLATE II, 1; MAP 3.

Cocos coronata Mart., Hist. Nat. Palm. 2:115. *t. 81.* 1826; Bondar, Bol. Inst. Centr. Fomento Econ. Bahia 11: *figs. 1-4, 16-18.* 1942; Palm. Brasil. 72: *figs. 13-15.* 1964. Lectotype: Brazil, Bahia et Pernambuco, *Martius 1869* (M). cf. Dahlgren 1959, *pl. 384.*

S. coronata var. *todari* (Becc.) Becc., Agric. Colon. 10:466. *t. 4.* 1916.

C. coronata var. *todari* Becc., Malpighia 1:453. 1887. Holotype: cult. Sicily, Orto Bot. Palermo, *Todare s.n.* (FI).

C. botryophora var. *ensifolia* Drude *in* Martius, Fl. Brasil. 3:409. 1881.

Arecastrum romanzoffianum var. *ensifolium* (Drude) Becc., Agric. Colon. 10:459. 1916. Holotype: cult. Brazil, Rio de Janeiro, *Glaziou 8058* (P).

Cocos quinquefaria Barb. Rodr., Palm. Hassler. Nov. 13. 1900; Sertum Palm. Brasil. 1: *t. 87A.* 1903. Lectotype: cult. Brazil, Jard. Bot. Rio de Janeiro (*t. 87A,* 1903).

S. treubiana (Becc.) Becc., Agric. Colon. 10:468. 1916.

Glaziova treubiana Becc., Ann. Jard. Bot. Buitenzorg, ser. 2, suppl. 3:791. *t. 31, figs. 1-8.* 1910. Lectotype: cult. Java, Bogor Bot. Gard., *Hort. Bot. Bog. X.D.48* (FI).

Trees 3-12 m tall, trunk with sharp persistent petiole scars, petioles usually grouped into 5 spiral rows around trunk. Sheathing leaf base and petiole 102 cm long and 7 cm wide at base (160 cm long and 20 cm wide—cultivated) margins of petiole armed with long, stiff, flat, spine-like fibers for most of its length; leaf rachis 164-216 cm long (242 cm—cultivated); pinnae 80-85 on each side (119 on each side—cultivated), mostly in clusters of 3-4, usually glaucous on both surfaces, those from middle series 60-66 cm long and 3.0-3.5 cm wide (72 cm long and 4.2 cm wide—cultivated), mostly with acuminate,

asymmetrical tips. Expanded part of sterile bract 42-75 cm long and 6-17 cm wide, deeply sulcate; branched part of inflorescence 33-51 cm long, rachillae 48-52 in number, each 25-29 cm long. Staminate flowers 12-16 mm long on proximal part and 7-11 mm on distal part, sepals 1-2 mm long, petals about 3 mm wide, anthers 3-4 mm long; pistillate flowers pyramidal, sepals longer than petals at anthesis, more or less nerved, averaging 9-12 mm long and 5-7 mm in diameter. Fruit ovoid, about 2.6 cm long and 1.8-2.0 cm in diameter, short beak, endocarp 2-3 mm thick along sides, 4-6 mm thick at extremities, cavity trivittate, smooth, slightly truncate at base. Seed ovoid, 1.4-1.6 cm long and about 1 cm in diameter.

Specimens examined. **Brazil.** BAHIA and PERNAMBUCO: *Martius 1869* (M, lectotype of *Cocos coronata*—1 sheet); *Martius s.n.* (M—2 sheets); BAHIA: vicinity of Bom Fim, 1915, *J. N. Rose & P. G. Russell 19825* (NY); Pituba, about 15 km N of Salvador, 1940, *Bondar s.n.* (F-619736); 1969, *Glassman & Costa 8723* (CHI); *Martius s.n.* (P); 30 km N of Jequié para Milagres, 1965, *Belém & Mendes 241* (BH). PERNAMBUCO: Garanhuns, estrada para Brejão, 1969, *Glassman & Costa 8702, 8703* (CHI); Arco Verde, 1966, *Costa 66-002* (IPA); Garanhuns, campos de cultura, 1929, *D. Bento Pickel 2178* (IPA).

CULTIVATED. **Brazil.** Rio de Janeiro, *Glaziou 8061* (C, FI, G, P); *Glaziou 18588* (F, K, MO, P); 1879, *Glaziou 8058* (P, holotype of *Cocos botryophora* var. *ensifolia;* C, F, FI, G, LE, R); 1926, *Dahlgren & Millar s.n.* (F-611627); São Paulo, Hort. Mus. Paulista, 1944, *Toledo & Handro 54168* (SP). **England.** London, 1928, *Knowles & Foster 63, 65* (K). **Sicily.** Orto Bot. Palermo, 1905, *Todare s.n.* (FI, holotype of *C. coronata* var. *todari*). **Belgian Congo.** Yangambi, 1959, *P. Bamps 52* (BH). **Indonesia.** Bogor Botanic Gardens, *Hort. Bot. Bog. X.D.48* (FI, lectotype of *Glaziova treubiana*). **United States.** FLORIDA: Chapman Field, Coconut Grove, 1954, *Moore 6815* (BH); Fairchild Tropical Garden, 1963, 1965, *Read 910, 1424* (BH).

Flowering from August to November.

Vernacular names: licuri, nicury, ouricury, licuryseiro, coqueiro dicori, cabeçudo.

Distribution: Native to Brazil, states of Bahia, Pernambuco, Minas Gerais, Sergipe, and Alagoas. Mostly in caatingas, occasionally in cerrados and cultivated areas.

No specimens were mentioned in Martius' original article (1826).

However, Bahia and Pernambuco were listed as localities. Hence, the above cited specimen collected by Martius was chosen as the lectotype.

Reasons for including *Cocos botryophora* var. *ensifolia* under this species have been discussed in Glassman (1968b) under *Syagrus* aff. *coronata.*

Cocos quinquefaria, originally described from cultivated plants in Jardim Botanico, Rio de Janeiro, apparently belongs here also, because Barbosa Rodrigues' description (1900) and illustration (*t. 87A,* 1903a) match *S. coronata* closely. As he cited no specimens, I have selected the specimen illustrated on *t. 87A* as the type. Burret (1937) also mentioned that this palm was closely related to *S. coronata.*

In previous articles (1965, 1970b), I considered *S. treubiana* to be a distinct species because of shorter pistillate flowers (6-7 mm rather than 9-12 mm in length) and narrower pinnae (2-3 cm rather than 3-4 cm in width). After observing the range of variation in hundreds of trees of *S. coronata* in Bahia, I have concluded that the two taxa are conspecific. Because type specimens of *S. treubiana* were collected from a relatively young tree in cultivation, the flowers and leaves are probably underdeveloped. Most of the other characteristics, especially the grouping of petioles on the trunk and the spiny petiole margins, match *S. coronata* very closely. In this connection, I collected specimens from a small tree close to the beach near Pituba, Bahia (*Glassman & Costa 8723*); the pistillate flowers were only 6-7 mm long and the pinnae were only about 2.2 cm wide. The small dimensions of this specimen may have been due to growth outside of its optimal habitats (caatingas and cerrados).

I have chosen *Hort. Bot. Bog. X.D.48* (FI) as the lectotype of *S. treubiana* because Beccari did not cite any specimens in either of his articles (1910, 1916). Burret (1937) listed specimens from (B) with the same collecting number, but the remaining data differ from the specimen that I cited from (FI): *Revier X.D.48* (Singapore n. 31, 121 leg. Furtado). I suspect this specimen was destroyed during World War II because it was not represented among the *Syagrus* specimens still remaining in the Berlin-Dahlem herbarium (see Glassman, 1969).

Because of its unique characteristics, such as petioles being grouped into five spiral rows on the trunk and petiole margins having long, flat, spine-like projections, *S. coronata* doesn't seem to be *closely* allied to any other species of *Syagrus.* It also seems to have one of the most

distinct flavonoid patterns of the nine species of *Syagrus* surveyed (Williams *et al.*, 1983). However, it apparently has some affinities with members of the *Syagrus* unit because it hybridizes with at least four different species: (1) *Arecastrum romanzoffianum* to form *S.* × *campos-portoana;* (2) *Arikuryroba schizophylla* to form *S.* × *tostana;* (3) *S. vagans* to produce *S.* × *matafome;* and (4) *S. oleracea,* resulting in *S.* × *costae.*

According to Bondar (1964), *S. coronata* grows best in granitic and calcareous soils and has not been found on siliceous or acid soils. He lists this species for the southern tip of Pernambuco, much of Bahia, and for Minas Gerais as far south as Rio Jequitinhonha. Although I have not collected *S. coronata* in the states of Sergipe and Alagoas, I have observed it in the following localities: in Sergipe it is abundant between Estancia and Itaparanga d'Ajuda, more or less common near Larangeiras, Maruim, Japaratuba, and Pacatuba, and sparse near Neopolis; in Alagoas it is more or less common in the vicinity of Penedo, Igreja Nova, and Junqueiro.

According to Costa (1967), *S. coronata* probably grows in most areas in Pernambuco with cultivated vegetation (agreste). In 1969, Mr. Costa and I saw this palm in the following localities: abundant between Garanhuns and Lagedo and in Arco Verde, fairly common in Canhotinho and Angelin, and rather sparse near Quipapa, Brejo da Madre de Deus, and São Bento do Una.

S. coronata reaches its greatest development as a major dominant of caatinga vegetation in the state of Bahia, where, according to Bondar (1942b), there are an estimated one-half billion trees. It is very common throughout much of the state except for the Atlantic coastal region, and it is especially abundant near Santa Terezinha, Santa Inez, Lagedo Alto, and Maracás. It is frequently associated with *S. vagans,* a common trunkless palm in these localities. The tallest and most vigorous specimens of *S. coronata* were seen between Maracás and Morros, whereas the smallest, least vigorous trees were located along the beach near Pituba, a suburb of Salvador.

The southernmost limit of *S. coronata* is in the vicinity of Itaobim, approximately where Rio Jequitinhonha crosses highway BR116 in Minas Gerais. This distribution more or less coincides with the southernmost limit of caatinga vegetation in Brazil, which is only about 5 km south of this locality. The westernmost limit of *S. coronata* is probably between Ibotarama and Barreiras in western Bahia. This

area is also close to the western limit of caatinga in Bahia, forming an ecotone with cerrado vegetation about 60 km west of Ibotarama.

According to Kitzke and Johnson (1975), the ouricury or licuri palm yields a commercial wax from the leaves, which is used as a substitute for carnauba wax. The ouricury wax industry came into prominence during the 1950's when carnauba wax was in short supply. The wax crop from *S. coronata* must be considered a bonus cash crop because there is greater commercial value in oil from the fruits.

29. Syagrus inajai (Spruce) Becc., Agric. Colon. 10:467. 1916; Dugand, Caldasia 7:148. 1955; Glassman, Fieldiana Bot. 31:155. *fig. 49.* 1965.

PLATE II, 6; MAPS 4, 6.

Maximiliana inajai Spruce, Jour. Linn. Soc. Bot. 11:163. 1871.

Cocos inajai (Spruce) Trail, Jour. Bot. 15 (n.s. 6): 79. 1877; Barb. Rodr., Sertum Palm. Brasil. 1: *t. 79A.* 1903. Holotype: Brazil, Amazon, Rio Negro, *Spruce 83* (K).

S. aequatorialis (Barb. Rodr.) Barb. Rodr., Prot.-Append. Enum. Palm. Nov. 33. 1879.

C. aequatorialis Barb. Rodr., Enum. Palm. Nov. Valle Amaz. 38. 1875. Superfluous substitute name.

S. speciosa (Barb. Rodr.) Barb. Rodr., Prot.-Append. Enum. Palm. Nov. 49. 1879.

C. speciosa Barb. Rodr., Enum. Palm. Nov. Valle Amaz. 38. 1875; Contr. Jard. Bot. Rio de Janeiro 4: *t. 24, fig. B.* 1907. Lectotype: "Ad fluvios Capim et Pixuna." Barb. Rodr., *t. 24, fig. B,* 1907. cf. Glassman 1972b, p. 94.

S. chavesiana (Barb. Rodr. ex Becc.) Barb. Rodr. Vellosia 1:52. 1888; Pl. Nov. Cult. Jard. Bot. Rio de Janeiro 2:108. 1891.

C. chavesiana Barb. Rodr. *ex* Becc., Malpighia 1:445. 1887; Barb. Rodr., Sertum Palm. Brasil. 1: *t. 79B.* 1903. Holotype: Brazil, Manaos, *Barbosa Rodriques s.n.* (FI).

Trees 8-12 m tall, 8-10 cm in diameter. Sheathing leaf base 50-70 cm long; petiole 70-97 cm long, 6 cm wide at base, usually with long fibrous margins for part of its length; leaf rachis 275-313 cm long,

with prominent patches of blackish indument; pinnae 90-101 on each side, mostly in clusters of 2-4, with brown indument along midrib, those from mid-section 70-77 cm long and 3-4 cm wide, with acute or acuminate, symmetrical tips, cross veinlets prominent on adaxial side. Expanded part of sterile bract 70-80 cm long and 9-10 cm wide, sulcate, with very thin layer of light-brown indument, becoming glabrous with age; branched part of inflorescence 35-38 cm long, rachillae 60-64 in number, each 28-31 cm long. Staminate flowers 10-11 mm long on proximal part of rachilla and 5-9 mm long on distal part, sepals 1-2 mm long, petals 2-3 mm wide, especially fleshy at tip, about 1 mm thick, anthers 3 mm long; pistillate flowers pyramidal, sepals and petals about equal in size at anthesis, 5-7 mm long and 5-7 mm in diameter. Fruit 3.5-4 cm long and 2.5-3 cm in diameter, short beak, endocarp 2-6 mm thick along sides, 3-6 mm thick at extremities, cavity more or less triangular in cross section, somewhat irregular in shape and truncate at base. Seed 1.5-2 cm long and 1.0-1.2 cm in diameter, more or less triangular in cross section, obtuse or truncate at apex, three lobed at base, with sculptured impressed sides.

Specimens examined. **Brazil.** AMAZONAS: Amazon, *Spruce 83* (K, holotype of *Maximiliana inajai*); campo near Manaos, 1875, *Trail 1122* (K); Parque A. Duque, on Manaos-Itacoatira Road, 1967, *H. E. Moore, L. Coelho, & G. T. Prance 9528* (BH, NY). Prov. do Alto, near Manaos, 1882 *Schwacke 4054* (FI); Manaos, *Barbosa Rodrigues s.n.* (FI, holotype of Cocos chavesiana—fruit only); 3 km into primary forest at km 20 of BR230, S of Altamira, 1977, *M. J. Balick, G. T. Prance, A. S. Silva, C. C. Berg, A. J. Henderson, B. W. Nelson, R. P. Bahia, & M. R. dos Santos 909* (F). PARÁ: Tocantins, 1907, *J. Kuhlmann s.n.* (F-611586); Nazareth dos Patos, Tocantins, 1924, *J. Kuhlmann 2099* (RB); Tapajos regions, Bôa Vista, 1932, *Capucho 524* (F); Belém, 1952, *J. M. Pires 4425* (US). **Colombia.** META: Los Llanos, Rio Casanare, Esmeralda, woods and savannas, 1938, *Cuatrecasas 3860* (COL); Rio Guayabero, selva, 1939, *Cuatrecasas 7559* (COL); llanos orientales, selva higrofilica, 1941, *A. Dugand & R. Jaramillo 2907* (COL); munic. Puerto Lopez, vicinity of Laguna de Yurimena, 1958, *R. Jaramillo, J. H. Camacho, & T. van der Hammen 1258* (COL); La Macarena, Rio Guayabero, sandy savannas, 1959, *H. Garcia Barriga & R. Jaramillo 17061* (COL); Qenane R., near highway from Villavicencio to Puerto Lopez, 1941, *D. Fairchild 1062* (COL); between Acacias and San Martin, orillas del

Rio Guamae, 1959, *V. M. Patiño s.n.* (COL); llanos orientales, E of S. Martin, N of Caño Camoa, 1963, *J. Blydestein 1688* (COL); VAUPÉS: Cerro de Circasia, 1939, *Cuatrecasas 7187 (COL); Mesa la Lindosa, S of San José del Guaviare, 1950, J. M. Idrobo & R. E. Schultes 679* (COL); San José del Guaviare, granitic soil, savanna, 1939, *Cuatrecasas 7487, 7708, 7709* (COL). **Surinam.** Palaime creek, savanna forest, 1963, *J. G. Wessels Boer 702* (F, U). **French Guiana.** 1845, *M. Melinon s.n.* (P).

CULTIVATED. **Brazil.** Jard. Bot. Rio de Janeiro, 1924, *L. H. Bailey & E. Z. Bailey 460* (BH); Museu Goeldi, Belém, 1940, *Dahlgren s.n.* (F-620810). DOUBTFUL. **Brazil.** without locality, *Glaziou 22263* (C); PARÁ: Rio Arama, 1900, *J. Huber 1887* (MG); Rio Arary, Teso de Vila Nova, 1902, *M. Guedes 2587* (MG); Marajó, Jutaba, 1902, *J. Huber 2731* (MG)

Flowering from January to July.

Vernacular names: curua rana, guariroba, pupunha de porco, pupanha-rana, -brava, inaja-y, jara-rana, jariva (Brazil); peh-peh (Surinam); churrubay, churruai, yay-pepe, maiz-pepe, saray, pupuña silvestre (Colombia).

Distribution: Native to Brazil, states of Pará and Amazonas; Colombia, Surinam, and French Guiana. Rain forests or savanna-like areas.

For *Cocos speciosa,* Barbosa Rodrigues (1875) cited *369.* However, this specimen was probably destroyed along with a number of his other palm collections. Therefore, an illustration was chosen as the lectotype.

Even though Beccari (1887) did not actually cite a specimen under *C. chavesiana,* he did mention that he received only fruiting specimens from Barbosa Rodrigues, which he described. I have seen these fruits from (FI), therefore I am satisfied that they represent the holotype of *C. chavesiana. Cocos aequatorialis* was originally described as a new name for *C. inajai* because, according to Barbosa Rodrigues, the native name, inaja-y, was not known in the province explored.

This taxon apparently has no close relatives in *Syagrus.* It seems to be most closely related to *Chrysallidosperma smithii* from Peru because both taxa have a triangular endocarp cavity and three lobed seeds with truncate ends. *Syagrus inajai* can be differentiated from *C. smithii* by the smaller pistillate flowers, smaller fruits, and homogeneous rather than ruminate endosperm.

Hybrids Involving *Syagrus*

At least five hybrids are known between species of *Syagrus* or between *Syagrus* and closely related genera. *Arecastrum romanzoffianum* is involved in two crosses, 1. with *S. coronata,* resulting in *S.* × *camposportoana* and 2. with *S. oleracea,* to form *S.* × *teixeiriana.* Of the remaining hybrids, *S.* × *costae* has *S. coronata* and *S. oleracea* as its parents, *S.* × *matafome* involves *S. vagans* and *S. coronata,* and *S.* × *tostana* is a cross between *S. coronata* and *Arikuryroba schizophylla.* Significantly, *S. coronata,* probably the most abundant palm in the state of Bahia, is a parent in four of these crosses, and *S. oleracea,* another common species in Brazil, is involved in producing two other hybrids. Another hybrid, between *Arecastrum romanzoffianum* and *Butia capitata* (× *Butiarecastrum nabonnandii*), will be treated with other genera in the *Syagrus* unit.

When the above hybrids were described or transferred, all genera in the *Syagrus* unit and *Butia* unit were lumped under *Syagrus, sensu lato.* As I have segregated *Syagrus* from other genera in this paper, it would be appropriate to give new names to the bigeneric hybrids. For now, however, I will not change the existing names because of insufficient evidence for establishing the parental origin of each hybrid. Most of the current information is based on gross morphology and leaf anatomy.

Syagrus × *camposportoana* (Bondar) Glassman, Fieldiana Bot. 31:392. *figs. 13-14.* 1968.

PLATE V, 2.

Cocos camposportoana Bondar, Field Mus. Nat. Hist., Bot. 22:460. 1942; Palm Brasil. 70: *fig. 18.* 1964. (*C. Campos-Portoana*).

Arecastrum camposportoanum (Bondar) Hawkes, Arq. Bot. S. Paulo 2:175. 1952.

S. camposportoana (Bondar) Glassman, Rhodora 65:260. 1963. Lectotype: Brazil, Bahia, cult., Fazenda Gangugy, municipio Poções, *Bondar s.n.* (F-619765).

Trees 3 m tall at 12 years, 30 cm in diameter, petioles grouped into spiral rows on trunk. Sheathing leaf base and petiole about 150

cm long and 20 cm wide at base; margins of petiole armed with long, flat spine-like fibers for most of its length; leaf rachis about 300 cm long; pinnae 130 on each side, mostly in clusters of 3-5, those near mid-section 105 cm long, 3-4 cm wide, mostly with acuminate, symmetrical tips. Expanded part of sterile bract 200-240 cm long and 25 cm wide (fide Bondar), sulcate; branched part of inflorescence 120-180 cm long, rachillae numerous, lower ones 80 cm long (fide Bondar). Staminate flowers 10-11 mm long (13-15 mm long—fide Bondar), petals about 2 mm wide, anthers 5 mm long; pistillate flowers pyramidal, sepals longer than petals at anthesis, 6-7 mm long and 4-5 mm in diameter (8-9 mm long—fide Bondar). Fruit 3 cm long and 2 cm in diameter, endocarp about 5 mm thick along sides and 6-8 thick at ends, cavity irregular in outline, grooved within. Seed gibbous-uncinate, easily separating from cavity, 1.1 cm long and 1.0 cm in diameter.

Specimens examined. **Brazil.** BAHIA: Fazenda Gangugy, municipio Poções, planted from seedlings coming from Itabuna, 1940, *Bondar s.n.* (F-619765, lectotype); *Bondar s.n.* (F-610582, 619766, 619767).

Flowering: no period listed.

Vernacular name: licuri-açu.

Distribution: Known only from type locality in cultivation.

This taxon is apparently a natural hybrid between *Arecastrum romanzoffianum* (chamisso) Becc. and *Syagrus coronata* (Mart.) Becc. Similarities and differences between the three taxa are shown in Glassman (1968b).

In Brazil in 1969, I spoke with a relative of the owner of the Fazenda where this hybrid grows. I did not have time to visit the place but learned information about the locality that differs somewhat from that originally published by Bondar. The present owner is Nelson Ferriera Santana and the name is Fazenda Entre Rios, Zona do Gongogir, Municipio de Iguai (formerly called Poções). I also learned that the owners have never been successful in germinating seeds of this hybrid.

It is uncertain if the two parent species actually hydridize under natural conditions. Although Itabuna (where the seedlings originally came from) is within the range of both *S. coronata* and *A. romanzoffianum*, I have not seen either species growing in that area. If natural hybrids exist at all, they are probably between Rio Jequitinhonha (the southernmost limit of *S. coronata*) and Rio Contas (the northernmost

limit of *A. romanzoffianum*) in Bahia, where the ranges of the two taxa overlap.

Anatomically, the hybrid is intermediate between both parent species, especially in the shapes of the midrib and adaxial nonvascular fibers. It resembles *S. coronata* more closely in that the abaxial nonvascular fibers are connected to a number of small veins.

Syagrus × *costae* Glassman, Fieldiana Bot. 32:244. *figs. 9-14.* 1970.

PLATE V, 3.

Holotype: Brazil, Pernambuco, 2 km W of Neves, *Glassman & Costa 8707* (CHI).

Trees 6-9 m tall. Sheathing leaf base about 23 cm long; petiole 50-60 cm long, margins covered at first for most of its length with a webbing, later separating out into individual soft or stiff fibers of narrow or intermediate width; leaf rachis 200-228 cm long; pinnae 124 on each side, mostly in clusters of 2-4, slightly glaucous on both surfaces, those from mid-section 75-80 cm long and 2.8-3.9 cm wide, with acuminate, asymmetrical tips. Expanded part of sterile bract 70-79 cm long and 20-21 cm wide, sulcate; branched part of inflorescence 66-73 cm long, rachillae 43-53 in number, lower ones 34-53 cm long. Staminate flowers 9-12 mm long on distal part and 13-16 mm long on proximal part, petals 3-4 mm wide, with patches of pale ramenta underlain by reddish glandular dots, anthers 5-6 mm long; pistillate flowers pyramidal, sepals longer than petals at anthesis, both wrinkled and nerved, with scattered patches of pale ramenta, 15-18 mm long and 6-8 mm in diameter. Fruit 2.8-3.2 cm long and 1.9-2.0 cm in diameter, short beaked, endocarp 3-4 mm thick along sides and above and 5-8 mm thick below, cavity smooth inside, angular truncate at base. Seed 1.4-1.5 cm long and 0.7-0.8 cm in diameter.

Specimens examined. **Brazil.** PERNAMBUCO: 2 km W of Neves, agreste, *Glassman & Costa 8707* (CHI, holotype); Garanhuns, Cagados, agreste, tree with about 200 fruits, *8704, 8705* (CHI).

DOUBTFUL. Garanhuns, estrada para Brejão, *Costa 67-0056* (IPA).

Flowering in June and October.

Vernacular names: none listed.

Distribution: Brazil, state of Pernambuco. Disturbed cerrados, pasture land, and cultivated land (agreste).

A chart showing similarities and differences between the hybrid and its two parents can be found in Glassman (1970c).

To my knowledge, this is the first example of a species of *Syagrus* forming hybrid stands or swarms. The other known hybrids between species in this genus and between *Syagrus* and other closely related genera are usually rare and are mostly represented by only one or two individuals in any particular area. Because of the frequent occurrence of *S.* × *costae,* it could be assumed that fewer barriers for hybridization exist between *S. coronata* and *S. oleracea* than for some other species. Another possible explanation for its frequent occurrence may be that the F_1 hybrids backcross with one or both parents; probably more frequently with *S. coronata* because of its abundance. There is some evidence for this theory, although insufficient specimens were collected to be conclusive. In *Glassman* and *Costa 8707,* the taste of "palmito" is neither sweet nor bitter, whereas in *8704* and *8705* it is sweet like *S. coronata.* There also seems to be some variation in the width and pliability of the fibers found on the petiole margins. Most of the specimens are intermediate between the two parent species; *8705* seems to approach *S. coronata* in width of fibers, but they are not as stiff.

Cross sections of the pinnae of *S.* × *costae* reveal an intermediate condition (between the two parents) in shape of the adaxial nonvascular fibers, but the abaxial nonvascular fibers are attached to some of the smaller veins, as in *S. coronata.*

Syagrus × *matafome* (Bondar) Glassman, Rhodora 65:260. 1963. ("mataforme").

FIG. 11; PLATE V, 5.

Cocos matafome Bondar, Field Mus. Nat. Hist., Bot. 22:459. 1942.

S. matafome (Bondar) Hawkes, Arq. Bot. S. Paulo 2:175. 1952. Lectotype: Brazil, Bahia, Municipio de Santa Teresinha, *Bondar s.n.* (F-619770).

Trees similar in appearance but shorter (3 m) than *S. coronata.* Petioles persistent on trunk, but not grouped into five spiral rows, about 100 cm long (fide Bondar), mostly with dentate margins for about lower one-half of its length; rachis about 200 cm long (fide

Bondar); pinnae 68 on each side, mostly in clusters of 2-4, usually glaucous on both surfaces, those from mid-section 47-55 cm long and 3.0-3.5 cm wide, mostly with acute, asymmetrical tips. Expanded part of sterile bract 78 cm long and 10 cm wide; branched part of inflorescence 73 cm long, rachillae 60 or more in number, each 40-43 cm long. Staminate flowers 8-10 mm long, petals 3 mm wide, with scattered reddish dots, calyx about 2 mm long, anthers 4-4.5 mm long; pistillate flowers pyramidal, sepals longer than petals at anthesis, 8-9 mm long, about 6-7 mm in diameter. Fruit oblong, 2.5-3.0 cm long and 1.5-2.0 cm in diameter, endocarp cavity smooth, endocarp 1.5-2 mm thick along sides and 2.5-3 mm thick at extremities. Seed 15 mm long and 11 mm in diameter.

Specimens examined. **Brazil.** BAHIA: Municipio of S. Teresinha, near Lagedo Alto, growing singly or in groups in association with *Cocos vagans* and *C. coronata, Bondar s.n.* (F-619770, lectotype). Without locality: *Bondar s.n.* (F-619771, 619772).

Flowering in June.

Vernacular name: matafome.

Distribution: Endemic to Brazil, state of Bahia.

Syagrus × *matafome* is known only from the type locality and appears to be a natural hybrid between *S. vagans* and *S. coronata.* Table 4 compares and contrasts the three taxa.

This table shows that *S.* × *matafome* has the following characteristics in common with *S. vagans:* dentate petiole margins and pinnae with acute, asymmetrical tips; and it is similar to *S. coronata* in the length of the rachis, width of pinnae, and shape of pistillate flowers. It is more or less intermediate between the two species in the size of the plant, number of pinnae per leaf, and lengths of pinnae, staminate and pistillate flowers, and fruit.

The hybrid seems to resemble *S. vagans* in its leaf anatomy more closely than *S. coronata;* however, some intermediate characteristics are evident.

During the latter part of June 1969, specimens of *S.* × *matafome* were collected in flower about 14 km west of Santa Teresinha, but these plants were later lost in transit. Apparently, this hybrid is rare; I observed only two trees in all of the localities where both parent species grow together in abundance.

Table 4. Comparison of *S. vagans*, *S. coronata*, and its hybrid

	S. vagans	*S. × matafome*	*S. coronata*
Height of plant	Without emergent stem	Tree about 3 m	Tree about 6-9 m
Grouping of leaves on trunk	No special grouping	No special grouping	Grouped into 5 spiral rows
Leaf			
Petiole margins	Dentate for at least proximal ⅓ of length	Dentate for at least proximal ½ of length	Not dentate, but with long, flat spine-like projections for most of length
Rachis length	100 cm	200 cm	216 cm
No. of pinnae per leaf	About 34 on each side	68 on each side	85 on each side
Arrangement of middle series pinnae	Regularly arranged	Mostly in clusters of 2-4	Clusters of 3-4
Pinnae tips	Acute and asymmetrical	Acute and asymmetrical	Acuminate and asymmetrical
Middle series pinnae			
width	2.0-2.5 cm	3.0-3.5 cm	3.0-3.5 (4) cm
length	40-50 cm	47-55 cm	66 cm
Branched part of inflorescence			
Length of staminate flowers	3-4 mm and 4-7 mm	8-10 mm	7-11 mm and 12-16 mm
Length, diameter and shape of pistillate flowers	5-7 × 5-7 mm rounded	8-9 × 6-7 mm pyramidal	9-12 × 5-7 mm pyramidal
Mature fruits			
Length and diameter	2.8-3.5 × 1.5-1.8 cm	2.5-3.0 × 1.5-2.0 cm	2.6 × 1.8-2.0 cm
Seeds			
Seed length and diameter	1.9-2.4 × 1.0 cm	1.5 × 1.1 cm	1.4-1.6 × 1 cm

Syagrus × *teixeiriana* Glassman, Fieldiana Bot. 32:27. *figs. 10-15.* 1968.

PLATE V, 6.

Holotype: Brazil, São Paulo, Fazenda Vanuir, *Glassman & Gomes 8007* (CHI), (erroneously cited as *8008* in Glassman, 1968c).

Trees about 4.1 m tall, about 15 cm in diameter. Sheathing leaf base 53 cm long, deteriorating into separate fibers; petiole 6 cm long; leaf rachis 210 cm long; pinnae 149 on each side, mostly in clusters of 3-5, slightly glaucous on both surfaces, those from mid-section 66 cm long and 2.7 cm wide, mostly with long, acuminate, symmetrical tips. Expanded part of sterile bract 82 cm long and 13 cm wide; branched part of inflorescence 56 cm long (fruiting—81 cm long), rachillae about 38 in number, each 41 cm long (fruiting—86 rachillae, each 48 cm long). Staminate flowers 15-17 mm long on proximal part and 8-12 mm long on distal part, petals 2 mm wide, anthers 4 mm long; pistillate flowers pyramidal, sepals longer than petals at anthesis, 7-7.5 mm long and 5-7 mm in diameter. Fruit ovoid, 3 cm long and 2 cm in diameter, short beak, endocarp 4-4.5 mm thick along sides and 7 mm thick at ends, cavity smooth inside, but slightly irregular in shape. Seed (only one seen) narrowly ovoid, inseparable from endocarp cavity, 1.3-1.4 cm long and 0.7 cm in diameter.

Specimens examined. **Brazil.** SÃO PAULO: 20 km N of Tupã, Fazenda Vanuir, part of stand of about 1,000 palm trees, 1965, associated with *S. oleracea* and *A. romanzoffianum, Glassman & Gomes 8007* (CHI, holotype).

Flowering in July.

Vernacular names: none recorded.

Distribution: Endemic to Brazil, state of São Paulo.

This taxon is an apparent hybrid between *S. oleracea* and *A. romanzoffianum.* The hybrid is probably rare because only one tree was recognized in the particular area studied and I have not seen it elsewhere. A table comparing the three taxa involved can be found in Glassman (1968c).

Anatomically, the hybrid closely resembles both parents, except for the shape of the midrib.

Flavonoid studies completed on the parents and their hybrid (Williams *et al.,* 1983) show that the hybrid differs from each parent by

three compounds, but one of these (kaempferol) is not found in either parent.

Syagrus × *tostana* (Bondar) Glassman, Fieldiana Bot. 31:393. *fig. 16.* 1968.

PLATE V, 4.

Cocos tostana Bondar, Field Mus. Nat. Hist., Bot. 22:458. 1942.

Arikuryroba tostana (Bondar) Hawkes, Arq. Bot. S. Paulo 2:175. 1952.

S. tostana (Bondar) Glassman, Rhodora 65:261. 1963. Lectotype: Brazil, Bahia, near Pituba, Salvador, 1940, *Bondar s.n.* (F-619775).

Trees about 7.5 m tall, 10-15 cm in diameter (fide Bondar). Sheathing leaf base not seen; petiole 116 cm long and about 6 cm wide at the base, margins armed with long, flat, spine-like projections for more than one-half the length, dentate beyond this point and gradually becoming devoid of spines about 10 cm from apex; leaf rachis 214 cm long; pinnae 65 on each side, regularly arranged, those from midsection 72 cm long and 4 cm wide, mostly with acuminate, symmetrical tips. Expanded part of sterile bract 82-97 cm long and 10 cm wide; branched part of inflorescence 79-94 cm long, rachillae numerous, each 45 cm long. Staminate flowers 11-14 mm long proximally and 8-11 mm long distally, petals 2 mm wide, with conspicuous orangish punctate glands, sepals 1-2 mm long, anthers 5 mm long; pistillate flowers pyramidal, sepals longer than petals at anthesis, with orangish punctate glands, 10-11.5 mm long and 6-7 mm in diameter. Ripe fruit orange in color, epicarp and mesocarp fleshy, 4 cm long and 2.3 cm in diameter, short beak, endocarp cavity smooth, endocarp 3-4 mm thick along sides and 5-6 mm thick at extremities. Seed about 2.1 cm long and 1.3 cm in diameter, endosperm homogeneous.

Specimens examined. **Brazil.** BAHIA: 1940, *Bondar s.n.* (F-619775, lectotype); *Bondar s.n.* (F-619776); Pituba, Salvador, 1940, *Bondar s.n.* (F-619735).

DOUBTFUL. **United States.** FLORIDA: cultivated, Fairchild Tropical Garden, Miami, Plot 76 (X-9-41C), 1965, *Read 1408* (BH, FAIR); same locality, Plot 73 (FG-1709A), 1969, *De Armand Hull H-9* (FAIR).

Flowering in November.

Vernacular names: None recorded.

Distribution: Native to Brazil, state of Bahia, near the coastal region of Pituba.

Similarities and differences between this taxon and the two parent species, *S. coronata* and *A. schizophylla,* are tabulated in Glassman (1968b).

Judging from the few specimens collected, *S.* × *tostana* is apparently rare. In Brazil in 1969, I was unable to find this hybrid in the vicinity of Pituba, a suburb of Salvador, where both parent species are found.

Read 1408 differs from the lectotype as follows:

	Read 1408 (FAIR)	*Bondar s.n.* (F-619885)
Length of pistillate flowers	7-9 mm	10-11.5 mm
Length of staminate flowers	9-10 and 7-9 mm	11-14 and 8-11 mm
Length of leaf rachis	257 cm	214 cm
Number of pinnae per leaf	134 on each side	65 on each side

The size of the sterile bracts and inflorescences, the unusual arrangement of spines on the petioles, and the size and shape of fruits are similar in both specimens (see description). The longer rachis and greater number of pinnae per leaf for this specimen may be attributed to better growing conditions under cultivation. The smaller pistillate and staminate flowers in *Read 1408* could be due to backcrossing with one of the parents, probably *A. schizophylla,* with pistillate flowers 5-8 mm long and staminate flowers 5-7 mm and 3-5 mm long. The other parent, *S. coronata,* has pistillate flowers 9-13 mm long and staminate flowers 12-16 mm and 7-11 mm long.

The other cultivated specimen, *De Armand Hull H-9,* has no flowers and has an incomplete rachis, but the pinnae are in clusters of 2-3 or singly arranged. This plant may also represent a backcross with one of the parents, probably *S. coronata,* which has pinnae arranged in clusters of 3-4.

Anatomically, *S.* × *tostana* more closely resembles *A. schizophylla,* but

some of the abaxial nonvascular fibers are attached to the smaller veins as in *S. coronata.*

Doubtful or Uncertain Species

Syagrus argentea (Engel) Becc., Agric. Colon. 10:465. 1916.
Cocos argentea Engel, Linnaea 33:690. 1865. Type: Colombia, without specific locality (no specimens cited).

Engel originally described this plant: a tree 60-80 feet tall, 8-10 inches in diameter. Leaf 15 feet long; 60-80 pairs of pinnae, acuminate, two feet long and one inch wide, 3-4 in a cluster; petiole margins fibrous. Spadix six feet long, branches 1-1.5 feet long. Fruit obovate.

The species is listed from Colombia without a specific locality. As no specimens were cited and none were found, and because certain diagnostic characteristics are lacking (size and texture of pistillate and staminate flowers and size and morphology of the fruit), I am designating *Syagrus argentea* as *species dubium.* Of three species of *Syagrus* known from Colombia, the incomplete description could fit either *S. orinocensis* or *S. sancona.*

Syagrus catechucarpa (Barb. Rodr.) Becc., Agric. Colon. 10:465, 469. 1916.
Cocos catechucarpa Barb. Rodr., Contr. Jard. Bot. Rio de Janeiro 2:41. *t. 2D.* 1901; Sertum Palm. Brasil. 1:107. *t. 80.* 1903. Lectotype: Brazil, cult. Jard. Bot. Rio de Janeiro no. 113 (*t. 80,* 1903). cf. Glassman 1972b, p. 89.

Barbosa Rodrigues (1901) gives the following characteristics of this plant: trunk 4-5 m long, 18 cm wide; pinnae 60 cm long and 3.3 cm wide, 2-3 in a cluster; inflorescence 1.2 m long, sterile bract 1.2 m long and 12 cm wide, sulcate outside, rachis 55 cm long, much branched, lower branches 28 cm long; pistillate and staminate flowers 10 mm long; fruit 4.3 cm long, 3 cm in diameter, turbinate, endocarp 4 mm thick, bony. The description was made from cultivated plants (Jardim Botanico Rio de Janeiro, no. 113), but no specimens have been found. The lectotype (*t. 80*) shows a cluster of pinnae, part of a sterile bract, fruits, and both pistillate and staminate flowers.

According to Beccari (1916), the description of vegetative parts and sterile bract apparently matches *Arecastrum romanzoffianum,* but the leaves, flowers and fruits of the lectotype resemble *Jubaea spectabilis.* It is possible that this specimen represents a mixture of two species, but it would be difficult to make a positive conclusion from this illustration. To my knowledge, the fruits do not resemble any known species of *Syagrus,* and the leaves and flowers could be those of a number of taxa of *Syagrus.* From the above discussion, it is virtually impossible to assign *S. catechucarpa* to any species of *Syagrus,* especially since there are no type specimens available for comparison. Therefore, I have designated it as *species confusum.*

Syagrus chiragua (H. Karsten) H. Wendl. *in* Kerchove, Les Palmiers, 257. 1878.
Platenia chiragua H. Karsten, Linnaea 28:250. 1857.
Cocos chiragua (H. Karsten) Becc., Malpighia 1:446. 1887.
Type: Colombia, Rio Magdalena (no specimens cited).

Nothing in Karsten's incomplete description indicates that this species belongs to *Syagrus:* tree 50-70 feet tall, leaves 12 feet long, pinnae 140 on both sides, 2 feet long. He also states that this palm grows, like *S. sancona,* to an altitude of 1000 m along Rio Magdalena, near Pamplona, Colombia. Because of the inadequate description and lack of illustrations and specimens, I am designating *S. chiragua* as *species dubium.*

Syagrus chloroleuca (Barb. Rodr.) Burret, Notizbl. Bot. Gart. Berlin-Dahlem 13:692. 1937.
Cocos chloroleuca Barb. Rodr., Contr. Jard. Bot. Rio de Janeiro 4:135. *t. 38.* 1907. Lectotype: cult. Jard. Bot., Rio de Janeiro (Barb. Rodr., *t. 38,* 1907).

No specimens were cited in the original article and none have been seen. Therefore, this entry is a *species dubia.*

Syagrus cogniauxiana (Barb. Rodr.) Becc., Agric. Colon. 10:466. 1916.
Cocos cogniauxiana Barb. Rodr., Sertum Palm. Brasil. 1:102. *t. 76A.* 1903. Holotype: Paraguay, Rio Apa, *Hassler 8553*

(G, destroyed?). Lectotype: Barb. Rodr., *t. 76A,* 1903. cf. Glassman 1972b, p. 89.

Barbosa Rodrigues described this species as a trunkless palm with leaf rachis 60 cm long; unclustered pinnae 39-40 cm long and 8 mm wide with oblique tips, brownish tomentose. Sulcate sterile bract 52 cm long and 7 cm wide; branched inflorescence with a rachis 18 cm long, lower rachillae 13-14 cm long. Staminate flowers 8 mm long, pistillate flowers 13 mm long. Fruit not seen.

Unfortunately, I have not been able to find the type specimen cited above among material sent from Geneva, where most of Hassler's collections are located.

Perhaps the only other trunkless species of *Syagrus* with which this taxon can be compared is *S. campylospatha* from Paraguay. The pistillate flowers are larger in *S. cogniauxiana* (13 mm rather than up to 8 mm), but the description may be based on young fruit rather than mature pistillate flowers. *Syagrus campylospatha* has clustered pinnae with appressed white-brownish pubescence on the upper surface, whereas the pinnae of *S. cogniauxiana* are described as unclustered and brownish tomentose. Although Barbosa Rodrigues' illustration (*t. 76A,* 1903a) shows a complete inflorescence, pinnae, and staminate and pistillate flowers that closely resemble *S. campylospatha,* I cannot be certain that *S. cogniauxiana* is synonymous with this species because herbarium specimens are not available for examination. Therefore, I choose to designate *S. cogniauxiana* as *species incerta.*

Syagrus edulis (Barb. Rodr.) Frambach *ex* Dahlgren, Field Mus. Nat. Hist., Bot. 14:266. 1936.
Cocos edulis Barb. Rodr., Contr. Jard. Bot. Rio de Janeiro 4:105. *t. 24A.* 1907. Lectotype: Brazil, Rio Grande do Norte (*t. 24A,* 1907). cf. Glassman 1972b, p. 90.

The following is a description of this species: stem 4-5 m tall, 10-15 cm in diameter. Leaves not seen. Sterile bracts sulcate, inflorescence 0.8-1.0 m long, leaf rachis 40 cm long, lower rachillae 36 cm long. Staminate flowers 20 mm long, pistillate flowers 18 mm long. Fruits 5.8 cm long and 4.0 cm wide, endocarp bony, 6 mm thick.

Syagrus edulis is found in the northern states of Brazil from Rio

Grande do Norte to Espirito Santo. Vernacular names are Catole or Babão. Barbosa Rodrigues says the leaves resemble *Cocos romanzoffiana* and are not described in the article because they were lost in transit. Albumen of the seed has an agreeable flavor and its oil extract is used in cooking and for illumination. No specimens were cited.

Description of the plant and illustration of flowers and fruits by Barbosa Rodrigues appear to resemble *S. oleracea* closely, but without an accurate description of the leaves, I cannot be certain of its true identity.

Syagrus getuliana (Bondar) Glassman, Rhodora 65:260. 1963.
Cocos getuliana Bondar, Bol. Inst. Centr. Fomento Econ. Bahia 9:35. *figs. 8-9.* 1941.
Barbosa getuliana (Bondar) Hawkes, Arq. Bot. S. Paulo 2:177. 1952. Lectotype: Brazil, Espirito Santo, São Mateus, 1941, *Bondar s.n.* (F-620823). cf. Glassman 1972b, p. 91.

Description: tree up to 20 m or more, trunk 15-20 cm in diameter. Petioles with fibrous margins; leaf rachis up to 2.5 m long; pinnae 2-7 in a cluster, up to 70 cm long and 2.5 cm wide, with intervals of 5-7 cm between clusters. Sterile bract sulcate, inflorescence up to 1.5 m long, rachis up to 90 cm long, rachillae 60-80 in number, each up to 30 cm long. Mature pistillate flowers not seen. Fruit elongate-elliptic, up to 6.5 cm long and 2.5 cm in diameter, endocarp with three lobes.

No specimens were cited by Bondar in his original paper (1941); therefore, the collection cited above was designated as lectotype. *Syagrus getuliana* resembles *S. macrocarpa* in size and clustering of pinnae, shape of fruits, and leaf anatomy; however, fruits of the former species have three or four endocarp lobes that extend through the mesocarp. This fruit characteristic may be an aberrant one, but it was not mentioned nor illustrated for *S. macrocarpa* by Barbosa Rodrigues (1903a). Furthermore, pistillate flowers are not represented in the type collection of *C. getuliana,* only the persistent perianth lobes of young fruits that are up to 25 mm long and floral scars that measure only 0.6 cm in diameter. *Syagrus macrocarpa* has very large pistillate flowers (25-35 mm long) and floral scars about 1.0 cm in diameter. Available

collections of *S. macrocarpa* are also incomplete (only flowers and parts of leaves have been seen); therefore, a careful comparison with *C. getuliana,* especially the pistillate flowers and fruits, is not possible at this time. In Brazil in 1969, I searched extensively but was unable to locate any trees in the vicinity of São Mateus that matched Bondar's description of *C. getuliana.* Hence, my only recourse is to designate this taxon as *species incerta.*

Syagrus petraea var. *platyphylla* (Drude) Becc., Agric. Colon. 10:467. 1916.

Cocos petraea var. *platyphylla* Drude *in* Martius, Fl. Brasil. 3:426. 1881; Barb. Rodr., Palm. Mattogross. *t. 8.* 1898; Sertum Palm. Brasil. 1: *t. 70B.* 1903. Holotype: Brazil, between Goyaz and Cuyaba, 1844, *Weddell 2952* (P).

The holotype material consists of two sheets; both have leaves, but only one sheet has floral parts. The pinnae are about 9 mm wide with oblique tips and resemble the leaves of *S. petraea,* but they are not of the same texture. The sterile bract is smooth or striate as in the genus *Butia,* the inflorescence is simple, and both staminate and pistillate flowers appear to be immature. *Weddell 2952* does not fall into any recognizable species of *Syagrus,* but as the flowers are immature and the leaves and floral parts may have come from different plants I am designating var. *platyphylla* as a *nomen confusum.* A published illustration, purported to be this variety by Barbosa Rodrigues (*t. 8,* 1898), is an excellent representation of *S. petraea,* but unfortunately, it was not illustrated from the holotype specimen of this variety.

Syagrus purusana (Huber) Frambach *ex* Dahlgren, Field Mus. Nat. Hist., Bot. 14:268. 1936.

Cocos purusana Huber, Bull. Herb. Boissier 2(4):271. 1906. Type: Brazil, Amazon, Rio Purus (no specimens cited).

The description of this palm is very brief: tree 15-20 m tall, branched part of inflorescence 1 m long, rachillae about 150 in number. Huber thought that *C. purusana* appeared to be intermediate between the medium sized species of the Amazon, *C. speciosa, C. inajai,* and *C. chavesiana,* and the tall species of central Brazil, *C. botryophora* and *C.*

acrocomoides. Without an adequate description, illustration, or specimen, it would be difficult to place *C. purusana* in any species of *Syagrus.* However, the palm Huber described is possibly an unusually large specimen of *S. inajai,* which normally has a shorter trunk (up to 12 m), a much shorter inflorescence (up to 38 cm), and fewer rachillae (up to 64).

Cocos rupestris Barb. Rodr., Prot.-Append. Enum. Palm. Nov. 45. 1879; Les Palmiers, 29. 1882. Type: Brazil, Minas Gerais, ad margines Rio Sapucahy, montibus Serra da Tromba, inter saxalaoideus, inter Gramineas.

Drude (1881) lists this species as a synonym of *Cocos petraea* Mart. No specimens were cited and no illustrations were published in either article of Barbosa Rodrigues. The description is too brief to determine where it might be placed; therefore, I have designated *Cocos rupestris* as *species incertum.*

Syagrus sapida (Barb. Rodr.) Becc., Agric. Colon. 10:468. 1916.

Cocos sapida Barb. Rodr., Palm. Nov. Parag. 12: *t. 3.* 1899; Sertum Palm. Brasil. 1:104. *t. 77A.* 1903. Type: Paraguay, dept. San Salvador, near Tagatiya and Santa Maria de Misiones. "Yatay-pindo," (no specimens cited). Lectotype: Barb. Rodr., *t. 77A,* 1903.

Barbosa Rodrigues gave the following description of this palm: trunk 2 m tall, 20-25 cm in diameter; leaves 2.7 m long, petiole 80 cm long, pinnae in clusters of 2-3, middle ones 50-56 cm long and 1.7 cm wide, tips oblique acuminate; sterile bract 1.2 m long and 13 cm wide, sharply sulcate and cottony tomentose outside; rachillae numerous, lower ones 30 cm in diameter, interior of fruit trivittate; seed 1.5 cm long and 1.0 cm in diameter.

The description and illustrations of this palm do not seem to fit any known species of *Syagrus* from Paraguay, but the shape of pistillate flowers and fruit bear a resemblance to *S. comosa* of Brazil. Because of the absence of type specimens, however, I am designating *S. sapida* as *species incertum.*

Excluded Species

S. amadelpha (Barb. Rodr.) Frambach *ex* Dahlgren, Field Mus. Nat. Hist., Bot. 14:264. 1936. = Butia sp.

S. amara (Jacq.) Mart., Palmet. Orbign. 132. 1844. = Rhyticocos amara (Jacq.) Becc.

S. archeri Glassman, Fieldiana Bot. 31:235. 1967. = Butia archeri (Glassman) Glassman.

S. arenicola (Barb. Hodr.) Frambach *ex* Dahlgren, Field Mus. Nat. Hist., Bot. 14:264. 1936. = Butia arenicola (Barb. Rodr.) Burret.

S. capitata (Mart.) Glassman, Fieldiana Bot. 32:143. 1970. = Butia capitata (Mart.) Becc.

S. dyerana (Barb. Rodr.) Becc., Agric. Colon. 10:466. 1916. = Butia yatay (Mart.) Becc.?

S. eriospatha (Mart. *ex* Drude) Glassman, Fieldiana Bot. 32:145. 1970. = Butia eriospatha (Mart. *ex* Drude) Becc.

S. hatschbachii Glassman, Fieldiana Bot. 31:240. 1967. = Butia microspadix Burret.

S. hoehnei Burret, Notizbl. Bot. Gart. Berlin-Dahlem 13:678. 1937. = Lytocaryum hoehnei (Burret) Toledo.

S. insignis (Hort. *ex* Drude) Becc., Agric. Colon. 10:467. 1916. = Microcoelum insigne (Hort. *ex* Drude) Burret & Potztal.

S. mikaniana (Mart.) Mart., Palmet. Orbign. 133. 1844. = Barbosa pseudococos (Raddi) Becc.

S. paraguayensis (Barb Rodr.) Glassman Fieldiana Bot. 32:151. 1970. = Butia paraguayensis (Barb. Rodr.) L. H. Bailey.

S. pseudococos (Raddi) Glassman, Fieldiana Bot. 32:233. 1970. = Barbosa pseudococos (Raddi) Becc.

S. romanzoffiana (Chamisso) Glassman, Fieldiana Bot. 31:382. 1968. = Arecastrum romanzoffianum (Chamisso) Becc.

S. schizophylla (Mart.) Glassman, Fieldiana Bot. 31:386. 1968. = Arikuryroba schizophylla (Mart.) L. H. Bailey.

S. smithii (H. E. Moore) Glassman, Fieldiana Bot. 32:231. 1970. = Chrysallidosperma smithii H. E. Moore.

S. weddelliana (H. Wendl.) Becc., Agric Colon. 10:468. 1916. = Microcoelum weddellianum (H. Wendl.) H. E. Moore.

S. weddelliana var. *cinerea* Becc., *ibid.* = Microcoelum weddellianum (H. Wendl.) H. E. Moore.

S. weddelliana var. *pinaertii* Hort. *ex* Nicholson, Dict. Hort. 5:754. 1899. = M. weddellianum (H. Wendl.) H. E. Moore.

S. wildemaniana (Barb. Rodr.) Frambach *ex* Dahlgren, Field Mus. Nat. Hist., Bot. 14:270. 1936. = Butia sp.?

S. yatay (Mart.) Glassman, Fieldiana Bot. 32:157. 1970. = Butia yatay (Mart.) Becc.

Taxonomic Treatment of Other Genera in *Cocos* Alliance

All published names and synonyms pertaining to genera and species treated in the present paper are included here. Because all of these genera except *Microcoelum* are monotypic, one description covers both the genus and species. Much of the basic information covered in the description of genus *Syagrus* can also apply to most of the other genera in the *Cocos* alliance. Members of the *Syagrus* unit are listed alphabetically, followed by *Cocos, Jubaea,* and *Jubaeopsis.* Each taxon is treated in the same format as *Syagrus,* for the most part; one intergeneric hybrid, × *Butiarecastrum,* is discussed, followed by a list of "Excluded Species."

Taxonomic Treatment of Genera in *Syagrus* Unit

ARECASTRUM (Drude) Becc., Agric. Colon. 10:446. 1916.

Cocos sect. *Arecastrum* Drude. 1881; *Cocos* subgen. *Arecastrum* (Drude) Becc. 1887; *Syagrus* sect. *Arecastrum* (Drude) Glassman, Fieldiana Bot. 32:231. 1970. Type species: *A. romanzoffianum* (Chamisso) Becc. A monotypic genus with description under its species below.

Arecastrum romanzoffianum (Chamisso) Becc., Agric. Colon. 10:447. 1916.

PLATE VI, 2; MAPS 10, 11.

Cocos romanzoffiana Chamisso, Choris Voyage Pitt. 5-6, *t. 5-6.* 1822; Barb. Rodr., Palm. Mattogross. *t. 4, 4A.* 1898; Sertum Palm. Brasil. 1: *t. 63.* 1903.

A. romanzoffianum var. *genuinum* Becc., Agric. Colon. 10:455. *t. 1-2, 3, fig. 7.* 1916.

Syagrus romanzoffiana (Chamisso) Glassman, Fieldiana Bot. 31:382.

figs. 10, 14. 1968; Principes 15: *figs. 1-5.* 1971. Type: Brazil, Santa Catarina, *Chamisso* (LE, destroyed). Lectotype: Chamisso (1822, *t. 5-6*) cf. Glassman 1972b, p. 94.

A. romanzoffianum var. *genuinum minus* Becc., Agric. Colon. 10:456. *t. 3, fig. 8.* 1916. Holotype: cult. Hyeres, France, 1909, *Chabaud s.n.* (FI).

A. romanzoffianum var. *australe* (Mart.) Becc., *ibid.* 459. *t. 3, figs. 2-6.* 1916.

Cocos australis Mart., Palmet. Orbign. 95. *t. 1, fig. 2; t. 30C.* 1844. Lectotype: Paraguay, Bonaire (Martius 1844, *t. 30C*).

A. romanzoffianum var. *micropindo* Becc., Agric. Colon. 10:462. *t. 3, fig. 1.* 1916. Holotype: Paraguay, Rio Ibicuy, 1913, *Spegazzini s.n.* (FI).

C. arechavaletana Barb. Rodr., Contr. Jard. Bot. Rio de Janeiro 2:43. *t. 5.* 1901; Sertum Palm. Brasil. 2: *t. 81.* 1903. Lectotype: Uruguay, Montevideo, *J. Arechavaleta s.n.* (FI).

C. acrocomoides Drude *in* Martius, Fl. Brasil. 3:409. *t. 87, fig. 3.* 1881. Holotype: Brazil, Mato Grosso, Rio Paraguay, forests along the banks of Rio Mondego, *Weddell 3251* (P).

C. martiana Drude & Glaz. *ex* Drude *in* Martius, Fl. Brasil. 3:418. *t. 88-89.* 1881. Lectotype: cult. Passeio Publico, Rio de Janeiro, Brazil, *Glaziou 8056* (P).

C. plumosa Hooker, Curtis Bot. Mag. 86: *t. 5180.* 1860. Lectotype: cult. Royal Botanic Gardens, Kew, England, *22-44/64* (K).

C. geriba Barb. Rodr., Prot.-Append. Enum. Palm. Nov. 43. 1879; Les Palmiers, 27. *t. 3, figs. 4-6.* 1882. Lectotype: Brazil, forests of Minas Gerais (Barb. Rodr., *t. 3, figs. 4-6,* 1882).

C. datil Griseb. & Drude *in* Griseb., Symbol. Flor. Argentina 24:283. 1879; Drude *in* Martius, Fl. Brasil. 3: *t. 93.* 1881; Barb. Rodr., Contr. Jard. Bot. Rio de Janeiro 4: *t. 24.* 1907. Lectotype: Uruguay, pr. concepcion (Drude, *t. 93,* 1881).

In the following description, numbers in parenthesis refer to certain cultivated specimens whose dimensions are larger than average.

Trees 10-15 (20) m tall, 40 cm or more in diameter. Sheathing leaf base 50-84 cm long; petiole 40-45 cm long and 4 cm wide, margins fibrous, becoming smooth with age; leaf rachis 2.5-3.2 m long; pinnae 147-165 on each side, mostly in clusters of 2-5, those from mid-section

70-85 cm long, 2-3 (3.8) cm wide, glaucous, mostly with acuminate, symmetrical tips. Expanded part of sterile bract 140-150 cm long, 18-21 cm wide and 5-8 mm thick, sulcate; branched part of inflorescence 90-125 cm long, rachillae 80-200 in number, each 62-66 cm long. Staminate flowers 11-16 mm long on proximal part of rachilla, 7-10 mm long on distal part, petals 3 mm wide, especially fleshy at tips, with conspicuous orange punctate glands, anthers 5 mm long; pistillate flowers rounded, sepals shorter than petals at anthesis, 4.5-6.0 (7) mm long and 4-6 mm in diameter, ovary tomentose. Mature fruit orange, soft mesocarp when ripe, 2.0-3.0 cm long and 1.2-1.8 (2.4) cm in diameter, slightly beaked, endocarp 0.5-0.8 cm thick, very irregular in shape. Seed gibbous-uncinate, not separating from endocarp cavity, 0.8-1.2 cm long and 0.6 cm in diameter, endosperm homogeneous.

Specimens examined. **Brazil.** BAHIA: 1940, *Bondar s.n.* (F-619773). MINAS GERAIS: Cidade de Caldas, *Regnell 1774* (F, NY, S, paratype of *Cocos martiana*); Alegnia, 1893, *Glaziou 20027* (K, P). GOIAS: Sitio de Buracão, 1894, *Glaziou 22258* (P). MATO GROSSO: Rio Paraguay, forete du bord du Rio Mondego, 1845, *Weddell 3251* (P, holotype of *Cocos acrocomoides*). ESPIRITO SANTO: São Mateus, campo, 1969, *Glassman & Costa 8743* (CHI). SÃO PAULO: Fazenda Vanuir, 20 km N of Tupã, 1965, *Glassman & Gomes 8008* (CHI); Fazenda Pedro Felipe, 18 km E of Marilia, 1965, *Glassman & Gomes 8010* (CHI). GUANABARA: environs of Rio de Janeiro, *Glaziou 13294* (C, F, FI, K, P); 1883-1884, *Glaziou 15560* (FI, K, P). PARANÁ: Antonina, 1879, *Schwacke 6510, 44588* (R). SANTA CATARINA: 1884, *Schwacke 5022* (FI); without definite state or locality, *Riedel s.n.* (FI, LE), *Escholtz s.n.* (LE), *Sellow s.n.* (LE). **Paraguay.** near Paraguari, 1874, *Balansa 2714* (P); without locality, 1888-1890, *Morong 233a* (NY); Cordillera de Altos, 1885-1895, *Hassler 704* (G, K, P); Villarica, common in woods, 1903, *P. Jorgensen 4184* (A, C, F, NY, S); Rio Ibicuy, 1913, *Spegazzini s.n.* (FI, holotype of *A. romanzoffianum* var. *micropindo*). **Argentina.** MISIONES: Posada, 1907, *Spegazzini s.n.* (FI); Puerto Leon, 1914, *H. H. Curran 711* (US); CORRIENTES: Dept. Mburucuya, Estancia Santa Teresa, 1954, *Peterson 2817* (G, P, S); Dept. Ituzaingo, San Carlos, en selva, 1971, *A. Krapovickas 17946* (F). **Uruguay.** ROCHA: Palmares de Castillos, 1944, *H. H. Bartlett 21397* (GH).

CULTIVATED. **Brazil.** Rio de Janeiro, Passeio Publico, 1875, *Glaziou 8056* (P, lectotype of *Cocos martiana;* C, F, FI, G, K, R); *Glaziou 2755* (P, paratype of *C. martiana*); 1882, *Glaziou 6518* (R); Quinta,

1887, *Glaziou 16482* (C, F, FI, K, LE, P, RB); Larangeiras, 1887, *Glaziou 17339* (C, F, FI, GH, K, NY, P); Rio de Janeiro, Jard. Bot., *Dahlgren s.n.* (F-611606, 611663), *Dahlgren & Millar s.n.* (F-611669). **Uruguay.** Montevideo, *J. Arechavaleta s.n.* (FI, lectotype of *Cocos arechavaletana*); 1897-1898 and 1914, *E. O. Fenzi s.n.* (FI); Dept. Montevideo, Atahualpa, 1925, *Herter 345* (F, G, NY, S), *Herter 345A* (F, G, GH, LE, M, NY, S); Dept. Salto, 1934, *Herter 345B* (F, G, GH, NY). **Argentina.** Buenos Aires, 1885, *Spegazzini s.n.* (FI). Prov. Corrientes: S. Luis Ole Palmar, 1971, *V. Maruñak 181* (F). **Guyana.** Georgetown, 1922, *Dahlgren s.n.* (F-610722), *Dahlgren & Persaud s.n.* (F-610582). **United States.** FLORIDA: Fairchild Tropical Garden, 1963, *Read 611* (FAIR); Ft. Meyers, 1924, *Dahlgren s.n.* (F-611079); Winter Haven, 1943, 1945, 1951, *Dahlgren s.n.* (F-404546). CALIFORNIA: Santa Barbara, 1908, *Franchesi s.n.* (FI). **Cuba.** *Moore 6116* (BH). **Martinique.** Jard. Bot., 1909, *J. W. Gillespie s.n.* (FI). **England.** *Royal Botanic Gardens, Kew, 22-44/64* (K, lectotype of *Cocos plumosa*); 1887, *Royal Botanic Gardens, Kew 25-44/64* (K). **France.** Hyeres, 1909, *Chabaud s.n.* (FI, holotype of *A. romanzoffianum* var. *genuinum minus*—fruits and photo); Toulone, Jard. Epremesnil, 1905, *Chabaud 2* (FI). **Italy.** Ventmiglia, Giardino La Mortola, 1911, 1912, *Berger s.n.* (FI); Palermo, *Todare s.n.* (FI). **Portugal.** Coimbra, 1887, *Henriques s.n.* (FI). **Canary Islands.** Tenerife, 1909, *Vilmorin-Andrieux s.n.* (FI); Orotawa, 1886, *Schenkel s.n.* (FI). **Java.** Buitenzorg, 1878, *Beccari s.n.* (FI); *Hort. Bot. Bog. 59, 60, 182, 245* (FI). **India.** Calcutta, 1902, *Prain s.n.* (FI). **Australia.** QUEENSLAND: 1943, *M. S. Clemens 43098* (A); *Hort. Bot. Brisbane s.n.* (FI).

DOUBTFUL. **Brazil.** PARANÁ: Iacarehy, 1914, *Dusen 15359* (F, G, GH, K, LE, M, NY, S). RIO GRANDE DO SUL: Hamburger Berg, 1898, *Lindman A573* (S), Silveira Martins, 1893, *Lindman A1255* (S). Without state or locality, *Riedel s.n.* (FI, LE). **Paraguay.** Asuncion, 1893, *Lindman A1693* (S).

Flowering from January to December.

Vernacular names: brejauba, pindó, geribá, guariroba, baba de boi, coco de sapo, coco de cachorro, imbury de cachorro (Brazil); pindó de Misiones, palma del monte, palma chiriva, cheribau, datil (Argentina, Uruguay); queen palm (Florida).

Distribution: Native to Brazil, states of Bahia, Minas Gerais, Espirito Santo, Goias, Mato Grosso, São Paulo, Guanabara (Rio de Janeiro), Paraná, Santa Catarina, and Rio Grande do Sul; Paraguay; Bolivia?;

Argentina; and Uruguay. In primary or secondary forests, in woodlands; generally not in cerrado or caatinga vegetation.

No specimens were cited by Chamisso (1822); hence the selection of *t. 5-6* as lectotype. Beccari (1916) says he saw an authentic Chamisso specimen from the herbarium in Leningrad and compared it with another specimen (*Schwacke* in 1884) collected near the type locality. Unfortunately, I was not able to locate any Chamisso collections among specimens sent to me on loan from Leningrad.

In his original description of *Cocos australis,* Martius (1844) lists the following: "Palmier Pindo, d'Orb. n. 2 cum icone." I interpret this to be a species number rather than the citation of a specimen. Dahlgren (1936) lists *D'Orbigny 5* as the type of this taxon, but no specimens collected by D'Orbigny (associated with this species name) have been located in the herbarium in Paris or in any other herbaria. Therefore, a lectotype (*t. 30C*) was chosen from illustrations.

No specimens were cited by Barbosa Rodrigues (1901) in describing *Cocos arechavaletana.* Therefore, a specimen (consisting of fruits only) bearing this name, and sent to Beccari in 1908, was chosen as lectotype.

For *Cocos martiana,* Drude (1881) cited *Glaziou 8056, Glaziou 2755,* and *Regnell 1774* without specifying the herbaria in which these specimens were located. I have selected *Glaziou 8056* (P) as the lectotype because it is the most complete collection (four sheets) and the only collection of this number with "TYPE" printed on the sheets.

No specimens were cited by Hooker for *Cocos plumosa;* hence, I selected a specimen (22-44/64-K, without collector's name) that is inscribed "from original plant."

Barbosa Rodrigues (1879, 1882) cited no specimens in his description and discussion of *C. geriba.* Therefore, his illustrations (Barb. Rodr., *t. 3, figs. 4-6,* 1882) have been chosen as lectotype.

In describing *Cocos datil,* no specimens were mentioned by Grisebach and Drude; however, Drude (1881) cited *Lorentz 800* from Uruguay and *Bonpland s.n.* from Buenos Aires and included an illustration (*t. 93*) of this taxon. Neither specimen could be located; therefore, *t. 93* was chosen as lectotype.

Because of the unique morphology of its seeds and fruit, *Arecastrum romanzoffianum* was described in a separate genus by Beccari (1916). However, it appears to have affinities with *Syagrus comosa* because both species have pistillate flowers and fruits of approximately the same

size and shape, clustered pinnae, and a similar leaf anatomy. It also seems to be allied to *S. botryophora,* as both species have pistillate flowers similar in size and shape, but the latter taxon has regularly arranged pinnae. Because of the apparent similarity between the two taxa, Beccari (1916) transferred *S. botryophora* to *A. romanzoffianum* var. *botryophorum* (Mart.) Becc.

Arecastrum romanzoffianum is the widest ranging species in the *Syagrus* unit. It is found in 10 states in eastern Brazil and extends into Paraguay, Uruguay, Argentina, and possibly Bolivia. Although this taxon has been reported from Bahia (northernmost limit is Rio Contas), it is probably confined to the coastal portion of that state. It has not been reported, nor have I seen it, from the central and western parts of Bahia, which consist principally of caatinga vegetation.

According to Baez (1933), *A. romanzoffianum* is common along shores and deltas of Rio Uruguay and Rio Paraná in the province of Entre Rios, Argentina. It is sympatric with *Butia yatay* in at least a few of these areas, but there are no confirmed reports of hybridization between the two taxa. Michalowski (1958) reports that *Arecastrum* is a solitary palm in Paraguay, occurring only as scattered individuals.

This taxon has a broad range of morphological variability as evidenced by the number of other species and variety names listed here in synonymy. Beccari (1916) recognized several varieties of *A. romanzoffianum* based mainly on differences in size and shape of fruits, but these differences seem to fall within the range of species variation. *Arecastrum* is one of the most successful palms in cultivation. It is probably planted in more different places throughout the world than any other cocosoid palm, with the possible exception of the coconut.

Certain specimens, e.g., *Dusen 15359, Lindman A573, A1255, A1693,* have been listed as doubtful because the collections appear to represent a mixture of species.

Several hybrids with *A. romanzoffianum* as one of the parents are recognized. *A. romanzoffianum* crosses with *S. coronata* in Bahia to form *S.* × *camposportoana,* with *S. oleracea* in São Paulo to produce *S.* × *teixeiriana,* and with *Butia capitata* (in cultivation) to produce × *Butiarecastrum nabonnandii.*

ARIKURYROBA Barb. Rodr., Pl. Nov. Cult. Jard. Bot. Rio de Janeiro 1:5. *t. 3.* 1891.

Arikury Becc., Agric. Colon. 10:445. 1916. Type species: *A. schizophylla* (Mart.) L. H. Bailey.

A monotypic genus with description under its species below.

Arikuryroba schizophylla (Mart.) Bailey, Gentes Herb. 2:196. 1930. PLATE VI, 3; MAP 10.

Cocos schizophylla Mart., Hist. Nat. Palm. 2:119. *t. 85.* 1826.

Arikury schizophylla (Mart.) Becc,, Agric. Colon. 10:445. 1916.

Syagrus schizophylla (Mart.) Glassman, Fieldiana Bot. 31:386. 1968; Phytologia 39:405. *figs. 1, 11-14.* 1978. Lectotype: Brazil, *Martius 1924* (M). cf. Dahlgren 1959, *pl. 7.*

Arikuryroba capanemae Barb. Rodr., Pl. Nov. Cult. Jard. Bot. Rio de Janeiro 1:6. *t. 3, fig. 1.* 1891; Sertum Palm. Brasil. 1: *t. 90A.* 1903.

Cocos capanemae (Barb. Rodr.) Drude *in* Engler & Prantl Pflanzenfam. Nachtrage 1,2(3):57. 1897.

Cocos arikuryroba Barb. Rodr., Palm. Mattogross. Nov. 25. 1898. Lectotype: Brazil, Bahia (Barb. Rodr., 1891, *t. 3, fig. 1*). cf. Glassman 1972b, p. 13.

Trees 2-4 m tall, frequently caespitose, sometimes flowering before trunk emerges. Sheathing leaf base 19-21 cm long, with fibrous and coarsely spiny margins; petiole 90-100 cm long, 4 cm wide at base, margins armed with short, curved teeth (often irregularly spaced) for most of length, teeth longer toward base (5 mm), becoming shorter toward apex (1-2 mm); leaf rachis 135-145 cm long; pinnae 40-43 on each side, regularly arranged, often widely spaced, those from midsection 56-59 cm long and 2.5-4.0 cm wide, with acute, asymmetrical tips, margins of tips frequently laciniate, mostly glabrous on both surfaces. Expanded part of sterile bract 65-70 cm long and 5-6 cm wide, sulcate; branched part of inflorescence 55-60 cm long, rachillae 28-32 in number, each 26-28 cm long, peduncle 65-71 cm long. Staminate flowers 5-7 mm long on proximal part and 3-5 mm long on distal part, petals about 1.5 mm wide, with small conspicuous reddish dots, sepals about 1 mm long, anthers 2-2.5 mm long; pistillate flowers rounded or ovoid, sepals shorter than petals at anthesis, 4.5-8 mm long and 3-6 mm in diameter. Mature fruit 2.5-3.0 cm long and 2.2-2.5 cm in diameter, short beak, endocarp cavity trivittate, smooth, endocarp 1-3 mm thick. Seed 1.7 cm long and 1.4 cm in diameter, endosperm ruminate.

Specimens examined. **Brazil.** PERNAMBUCO: Cabo de Santo Agutinho, 1953, *D. A. Lima s.n.* (IPA-53-1655); Porto de Galinhas Estacão Experimental de Litoral Ipa, 1967, *Paulo Ferreira s.n.* (IPA-67-35); in restinga, 1969, *Glassman & Costa 8708* (CHI). BAHIA: *Martius 1924* (M, lectotype of *Cocos schizophylla*); *Martius 1853* (P); *Blanchet 4* (G); *Blanchet 40* (P); Salvador, *Bondar s.n.* (F-404610, 620750, 619774); between Amaralina and Pituba, *Dahlgren s.n.* (F-620690); Ilheus, 1918, *H. M. Curran 437* (F); Porto Seguro, 1961, *A. P. Duarte 5977* (RB); Pituba, suburb of Salvador, in clumps along beach, in coconut grove, 1969, *Glassman & Costa 8721, 8722* (CHI); 7 km S of Ilheus, 1969, along sandy beach, *Glassman & Costa 8741* (CHI).

CULTIVATED. **Brazil.** SÃO PAULO: Piraçicaba, *W. Accorsi s.n.* (SP-51,563); Rio de Janeiro, Jardim Botanico, *Dahlgren s.n.* (F-611536). **Guyana.** Georgetown, *Dahlgren s.n.* (F-610650). **Cuba.** Soledad, Harvard Tropical Garden, *Jack 4482* (A). **United States.** FLORIDA: Fairchild Tropical Garden, *Dahlgren 50/052* (F).

Flowering from June to January.

Vernacular names: aricury, ariry guriri, nicury, aricuryroba, nicuryroba.

Distribution: Native to Brazil, states of Pernambuco and Bahia. Mostly limited to sandy soil close to the Atlantic coastal areas, along beach (strand) or in forested areas (restinga).

Even though *A. schizophylla* is so distinct morphologically (spiny petiole margins and seeds with ruminate endosperm) that it is recognized as a separate genus by most authors, this taxon appears to be allied to a group of species of *Syagrus* (*S. ruschiana, S. vagans, S. werdermannii, S. harleyi,* and *S. microphylla*) with a similar leaf anatomy pattern (Glassman, 1978b).

Arikuryroba schizophylla is known to cross with *S. coronata* (where their ranges overlap) in coastal Bahia to produce the hybrid, *S.* × *tostana* (Bondar) Glassman. This hybrid is apparently rare because it is known from only a few collections.

Ledin (1958) discusses cultivation of this palm in Cuba and in the United States. It was probably introduced into Florida by Reasoner's Royal Palm Nursery during the early 1900's. At present, *Arikuryroba* appears to be limited to the southern part of that state, which is free of prolonged cold spells.

Fig. 11 in Glassman (1968b) is captioned as *Syagrus schizophylla* from

Salvador, but the trees in this Bondar photo are actually *Syagrus coronata.*

BARBOSA Becc., Malpighia 1:349. 1887.

Langsdorffia Raddi, Mem. Soc. Ital. Sci. Modena. 18:345. *t. 1.* 1820. Later homonym of *Langsdorffia* Mart. 1818 (Balanophoraceae).

Cocos sect. *Langsdorffia* (Raddi) Drude *in* Martius, Fl. Brasil. 3:401. 1881.

Syagrus sect. *Barbosa* (Becc.) Glassman, Fieldiana Bot. 32:232. 1970. Type species: *B. pseudococos* (Raddi) Becc.

A monotypic genus with description under its species below.

Barbosa pseudococos (Raddi) Becc., Malpighia 1:349, 352. 1887; Barb. Rodr., Sertum Palm. Brasil. 1: *t. 91.* 1903; Dahlgren, Index Amer. Palms *pl. 78.* 1959.

FIG. 17; PLATE VI, 4.

Langsdorffia pseudococos Raddi, Mem. Soc. Ital. Sci. Modena 18:345, 347. *t. 1.* 1820.

Syagrus pseudococos (Raddi) Glassman, Fieldiana Bot. 32:233. 1970. Type: Eastern Brazil (no specimens cited). Lectotype: Raddi (1820, *t. 1*).

Cocos mikaniana Mart., Hist. Nat. Palm. 2:128. 1826.

S. mikaniana (Mart.) Mart., Palmet. Orbign. 133. 1844; Hist. Nat. Palm. 3:291. *t. 166, fig. 1.* 1845; 3:324. 1853. Type: Brazil, Rio de Janeiro (no specimens cited). Lectotype: Martius (1845, *t. 166, fig. 1*).

Trees 10-15 m tall, 25 cm in diameter. Sheathing leaf base about 44 cm long and 23 cm wide; petiole 81 cm long and 5 cm wide, margins fibrous or smooth; leaf rachis 210-220 cm long; pinnae 145-150 on each side, mostly in clusters of 2-4, those from mid-section 80-85 cm long and 4 cm wide, with acuminate, asymmetrical tips. Complete sterile bract not seen, sulcate; inflorescence 80-90 cm long (fide Beccari), rachillae 30-34 cm long. Staminate flowers 14-22 mm long, petals 5 mm wide, with small orangish dots, tips broadly acute or obtuse, anthers 9-10 mm long; pistillate flowers oblong, sepals longer than petals at anthesis, both with obtuse keeled tips, 20-32 mm long and 12-13 mm in diameter. Mature fruit 6.0-6.8 cm long and 3.8-4.0 cm in diameter, beak about 8 mm long, endocarp 1.5

mm thick along sides and 9 mm thick at upper end, cavity trivittate within. Seed 2.8 cm long and 2.5 cm in diameter, endosperm deeply ruminate.

Specimens examined. **Brazil.** GUANABARA (RIO DE JANEIRO): Rio d'Ouro, Chez Moeoreira, 1879, *Glaziou 11638* (BM, C, FI, K, P, R); Teresopolis, 1886, *Glaziou 9009* (C, G, K, LE, P); Nova Iguaçu, Jacaruba, 1978, *Fernando de Oliveira 455* (BH). SÃO PAULO: São Sebastian, *Bondar s.n.* (F-404607); Munic. Paraibuna, 25 km along highway SE of Paraibuna, pasture land, two trees remnant of original forest, 1961, *G. & L. Eiten 2786* (SP-74425).

CULTIVATED. **Brazil.** Rio de Janeiro, *Glaziou 8048* (C, K, P); Jardim Botanico, *Dahlgren s.n.* (F-611608, 611609). BAHIA: 1941, *Bondar s.n.* (F-620751). **Java.** Buitenzorg, 1936, *Furtado 31143* (A); Hort. Bog., *V. M. Leta 221, 249* (FI).

Flowering from March to August.

Vernacular names: coco amargoso, coco verde, palma blanca, guariroba, patyoba, peririma.

Distribution: Native to Brazil, states of Guanabara (Rio de Janeiro) and São Paulo. Forested areas or pastures.

This taxon was originally described as a palm in the genus *Langsdorffia* by Raddi in 1820; however, this name is a homonym because *Langsdorffia* in the Balanophoraceae was described earlier by Martius in 1818. No specimens were cited by Raddi; hence the selection of an illustration as lectotype. Dahlgren (1936) cited *Mikan s.n.* as a type of *Cocos mikaniana,* but no specimens were listed by Martius (1826) in his original article, nor could any of Mikan's collections be found. Therefore, an illustration was chosen as lectotype. Dahlgren (1936, 1959, *pl. 78*) also cited *Glaziou 11638* (collected in 1879) under *C. mikaniana,* but I do not feel obligated to choose this specimen as a lectotype because it was not associated with any of the articles by Martius (1826, 1844, 1853).

Barbosa pseudococos with its large, obtuse pistillate flowers, large, long-beaked fruits, and seeds with ruminate endosperm does not appear to have close affinities with any other species in the *Syagrus* unit.

Because I have seen only a few recent collections, I can only assume that this genus is rare and could be nearing extinction in the native state. Most of the forested areas where the palms originally grew appear to have been destroyed.

CHRYSALLIDOSPERMA H. E. Moore, Principes 7:109. *figs. 73-76.* 1963.

Syagrus sect. *Inajai* Glassman, Fieldiana Bot. 32:230. 1970. (in part, as to nomenclature, but not type which = *S. inajai*). Type species: *C. smithii* H. E. Moore.

A monotypic genus with description under its species below.

Chrysallidosperma smithii H. E. Moore, Principes 7:110. *figs. 73-76.* 1963.

MAP 11.

Syagrus smithii (H. E. Moore) Glassman, Fieldiana Bot. 32:231. 1970. Holotype: Peru, Loreto, *Moore, Salazar, & Smith 8516* (BH).

Trees up to 10 m tall, 8 cm in diameter. Sheathing leaf base not seen; petiole 90 cm long and about 2.5 cm wide, margins fibrous, becoming smooth with age; leaf rachis 2-3 m long; pinnae 83-92 on each side, in clusters of 2-4, those from mid-section 66 cm long and 3.7 cm wide, mostly with acute or acuminate, symmetrical tips. Expanded part of sterile bract up to 85 cm long and 14 cm wide, sulcate; branched part of inflorescence about 50 cm long, rachillae about 35 in number, each 40 cm long. Staminate flowers 13 mm long on proximal part of rachilla and 11 mm long on distal part; pistillate flowers pyramidal, sepals longer than petals at anthesis, 12 mm long and 9-10 mm in diameter. Fruit narrowly ovoid or ellipsoid, about 7 cm long and 3.5-4.2 cm in diameter, endocarp cavity more or less triangular in cross section, trivittate within, endocarp 7-9 mm thick. Seed about 3.5 cm long and 1.8-2.0 cm in diameter, more or less three-lobed in cross section, truncate at both ends, with impressed, sculptured sides, endosperm ruminate.

Specimens examined. **Peru.** LORETO: Province Alto Amazonas, open wooded slopes with acid sandy clay soils (pH 4.5), between km 13-14 on Yurimaguas-Tarapoto road, 1960, *Moore, Salazar, & Smith 8516* (BH, holotype; USM); Province Coronel Portillo, wooded slopes 6-8 km beyond Aguaytía on road to San Alejandro, about 330 m alt., 1960, *Moore, Salazar, & Smith 8375* (BH; USM).

Flowering in April and May.

Vernacular names: none recorded.

Distribution: Native to Peru, Dept. Loreto. Forested areas.

According to H. E. Moore (1977), *C. smithii* is known only from

two small areas: one near Aguaytía, the other near Yurimaguas. He revisited the first area in 1974 (original visit was in 1960) and noticed that most of the natural vegetation in the region where this palm grew had been cut down.

This taxon was previously transferred to *Syagrus* and placed in the same section as *S. inajai* (Glassman, 1970b) because of the similarity of their fruits and seeds. Both species have a triangular shaped endocarp cavity and a triangular 3-lobed seed with truncate ends and impressed sides. The main differences are that *C. smithii* has ruminate rather than homogeneous endosperm, larger pistillate flowers (12 mm rather than 5-7 mm), and longer fruits (7 cm rather than 4 cm). Although I am considering the two taxa under different genera because of the endosperm character, they could have had a common origin.

LYTOCARYUM Toledo, Arq. Bot. S. Paulo 2:6. 1944.

Syagrus sect. *Glaziova* (Mart. *ex* Drude) Burret, Notizbl. Bot. Gart. Berlin-Dahlem 13:677. 1937; Glassman, Fieldiana Bot. 32:215. 1970. Type species: *Lytocaryum hoehnei* (Burret) Toledo.

A monotypic genus with description under its species below.

Lytocaryum hoehnei (Burret) Toledo, Arq. Bot. S. Paulo 2:7. *t. 1-2.* 1944.

PLATE VI, 5; MAP 10.

Syagrus hoehnei Burret, Notizbl. Bot. Gart. Berlin-Dahlem 13:678. 1937; Glassman, Fieldiana Bot. 32:237. 1970. Holotype: Brazil, São Paulo, Barragem nova de Cotia, *A. Gehrt s.n.* (SP-25.318).

Trees 3-5 m tall. Sheathing leaf base about 8 cm long and 4 cm wide; petiole up to 44 cm or more long and 2 cm wide, margins fibrous, patches of brownish-tomentose hairs on lower surface; leaf rachis up to 150 cm long (fide Burret), with patches of brownish-tomentose hairs of variable thickness; pinnae 56-60 on each side, regularly arranged, those from mid-section 38-40 cm long and 1.5-2.0 cm wide, with acuminate, asymmetrical tips, mostly densely brownish pubescent on upper surface, glabrous on lower surface. Expanded part of sterile bract 52-56 cm long and 7 cm wide, deeply sulcate, brownish tomentose; branched part of inflorescence 38-40 cm long, rachillae 34-38 in number (45-50, fide Burret), each 17-19 cm long.

Staminate flowers 6-8 mm long, petals 3 mm wide, with tiny reddish dots, anthers 4 mm long; pistillate flowers pyramidal, sepals slightly shorter than petals at anthesis, both distinctly nerved on apical half, nerves obscured by reddish punctate glands on basal half, 6-8 mm long and 5-6 mm in diameter. Fruit 3.0-3.3 cm long and 2.0-2.3 cm in diameter, beak about 3 mm long, mesocarp usually dehiscing along 2 or 3 seams at maturity, endocarp less than 1 mm thick, cavity trivittate, smooth. Seed about 1.7 cm long and 1.3 cm in diameter, endosperm ruminate.

Specimens examined. **Brazil.** SÃO PAULO: Barragem nova de Cotia, 1930, *A. Gehrt s.n.* (SP-25.318, holotype; B, BH); Matta do Governo, 1924, *A. Gehrt s.n.* (SP-9716, paratype); Aldeinha, 1940, *A. Gehrt s.n.* (SP-43163); Cubatão, 1930, *F. C. Hoehne s.n.* (SP-26520, paratype); Parelheiro, Santo Amaro, 1930, *F. C. Hoehne s.n.* (SP-26521, paratype); Miracatu, near Pedro Barros, in virgin forest, 1966, *J. Mattos 13844* (SP-119131).

CULTIVATED. **Brazil.** São Paulo, Ypiringa, 1921, *H. Luederwaldt s.n.* (SP-12270, paratype); Jardim Botanico, 1943, *Toledo & Handro s.n.* (SP-51606; BH).

Flowering from April to December.

Vernacular names: none recorded.

Distribution: Native to Brazil, state of São Paulo. Mostly in open woodlands and forests.

This species apparently forms a natural grouping with *M. insigne* and *M. weddellianum* because of its very thin endocarp and mesocarp, which dehisce along three sections at maturity. *Lytocaryum hoehnei* is a distinct genus and can be separated from its two closest relatives by the longer and wider pinnae, which are brownish pubescent rather than silvery glaucous, longer staminate and pistillate flowers, and, especially, the ruminate rather than homogeneous endosperm.

MICROCOELUM Burret & Potztal, Willdenowia 1:387. 1956.

Glaziova Mart. *ex* Drude *in* Martius, Fl. Brasil. 3:395. 1881. Homonym of *Glaziova* Bureau. 1868 (Bignoniaceae).

Syagrus sect. *Glaziova* (Mart. *ex* Drude) Burret, Notizbl. Bot. Gart. Berlin-Dahlem 13:677. 1937; Glassman, Fieldiana Bot. 32:215. 1970. Lectotype: *Microcoelum weddellianum* (H. Wendl.) H. E. Moore. cf. H. E. Moore, 1963b, p. 267.

Trees 1-3 m tall, 10-15 cm in diameter. Sheathing leaf base 10-51 cm wide, blackish or blackish-brown pubescent or tomentose; petiole 3-39 cm long, margins fibrous; leaf rachis 65-85 cm long, usually with patches of blackish-brown hairs; pinnae 50-60 on each side, regularly arranged, usually silvery glaucous above and grayish-green below, those from mid-section 18-30 cm long and 0.5-1.5 cm wide, with acuminate, asymmetrical tips. Expanded part of sterile bract 34-54 cm long and 2.5-4.3 cm wide, sulcate, chestnut-brown tomentose or blackish-brown tomentose, becoming glabrous with age; branched part of inflorescence 32-37 cm long, rachillae 40-62 in number, occasionally rebranched, each 8-20 cm long. Staminate flowers 2.5-5.0 mm long, petals 1.5-2.5 mm wide, with small conspicuous reddish dots, anthers 1.5-2.0 mm long; pistillate flowers pyramidal, sepals and petals distinctly nerved or with scattered white indument and reddish-brown dots, 2.5-5.0 mm long and 2.5-4.0 mm in diameter. Fruit 1.7-2.3 cm long and 1.0-1.6 cm in diameter, mesocarp usually dehiscing along 2 or 3 seams when mature, endocarp fragile, less than 0.5 mm thick, cavity trivittate, smooth. Seed ovoid, globose or flattened dorsoventrally, 0.6-1.5 cm long and 0.9-1.3 cm in diameter, endosperm homogeneous.

Microcoelum weddellianum (H. Wendl.) H. E. Moore, Gentes Herb. 9:267. 1963.

FIG. 13; PLATE VI, 6; MAP 10.

Cocos weddelliana H. Wendl. *in* T. Moore, Florist & Pomol. 1871:114. 1871.

Syagrus weddelliana (H. Wendl.) Becc., Agric. Colon. 10:468. 1916; Dahlgren, Index Amer. Palms *pl. 397.* 1959.

Lytocaryum weddellianum (H. Wendl.) Toledo, Arq. Bot. S. Paulo 2:8. *t. 3.* 1944. Lectotype: Brazil, Rio de Janeiro, Serra dos Orgãos, 1832, *M. Lhotsky 8* (G).

Glaziova martiana Glaz. *ex* Drude *in* Martius, Fl. Brasil. 3:397. *t. 86.* 1881. Published as a new name for *Cocos weddelliana* H. Wendl.

Microcoelum martianum (Glaz. *ex* Drude) Burret & Potztal, Willdenowia 1:388. 1956. Illegitimate name because *Cocos weddelliana* was cited as a synonym.

Syagrus weddelliana var. *cinerea* Becc., Agric. Colon. 10:468. 1916.

Lytocaryum weddellianum var. *cinereum* (Becc.) Hawkes, Arq. Bot. S.

Paulo 2:190. 1952. Holotype: Brazil, Rio de Janeiro, *Glaziou 2758* (FI).

S. weddelliana var. *pinaertii* Hort. *ex* Nicholson, Dict. Hort. 5:754. 1899.

L. weddellianum var. *pinaertii* (Hort. *ex* Nicholson) Hawkes, Arq. Bot. S. Paulo 2:190. 1952. Type: Cultivated in nursery of Pynaert van Gurt, Ghent, Belgium (no specimens cited).

Plants with trunks 1-3 m tall, 10-15 cm in diameter. Sheathing leaf base 10-12 cm long and about 7 cm wide, frequently with patches of blackish hairs; petiole 30-39 cm long, margins fibrous; leaf rachis 65-71 cm long; pinnae 50-60 on each side, regularly arranged, usually silvery glaucous above and grayish-green below, those from mid-section 18-21 cm long and 0.5-0.8 (1.2) cm wide, with acuminate, asymmetrical tips. Expanded part of sterile bract 34-40 cm long and 2.5 cm wide, sulcate, chestnut-brown tomentose, becoming glabrous with age; branched part of inflorescence 32-36 cm long, rachillae 58-62 in number, each averaging 8-13 cm long. Staminate flowers 2.5-5.0 mm long, petals 1.5 mm wide, with conspicuous reddish dots, anthers about 1.5 mm long; pistillate flowers pyramidal, sepals longer than petals at anthesis, both distinctly nerved, 2.5-5.0 mm long and 3-4 mm in diameter. Fruit about 1.7 cm long and 1.0-1.5 cm in diameter, mesocarp usually dehiscing along 2 or 3 seams when mature, endocarp fragile, less than 0.5 mm thick, cavity trivittate, smooth. Seed ovoid, globose or flattened dorso-ventrally, 0.6-1.5 cm long and 0.9-1.2 cm in diameter, endosperm homogeneous.

Specimens examined. **Brazil.** 1832, without locality, *M. Lhotsky s.n.* (G)—2 sheets. GUANABARA: Serra dos Orgãos, 1832, *M. Lhotsky 8* (G, lectotype; A, F), 1862, *Glaziou 288* (P); 1883, *Herb. Saldanha* (R-44.707); 1891, *Uhle 1978* (R); 1894, *Uhle s.n.* (R-44.582); Teresopolis, 1883, *Herb. Saldanha* (R-6726), 1887, *H. Schenck s.n.* (FI-2957); Petropolis, 1886, *Glaziou 16478* (BM, F, NY, P); Rio de Janeiro, 1838-42, *Wilkes Exploring Expedition s.n.* (GH); *Glaziou 3635* (C, P); *Glaziou 8051, Burchell 2530* (K, P); *Glaziou 2758* (FI, holotype of *S. weddelliana* var. *cinerea;* MO).

CULTIVATED. **Brazil.** Rio de Janeiro, Jardim Botanico, 1923, 1924, *L. H. Bailey & E. Z. Bailey 336, 336a, 336b, 602* (BH); 1926, *Dahlgren s.n.* (F-611646, 611698); Teresopolis, in greenhouse, *F. C. Hoehne 2319* (SP); São Paulo, Ypiranga, Hort. Bot., 1915, 1917, 1921,

H. Luederwaldt s.n. (SP-12256, 12258, 12272, 24153); Jard. Bot. São Paulo, 1944, *J. F. Toledo s.n.* (SP-50434; F).

Flowering during all months of the year.

Vernacular names: palmerinha de petropolis, ico, jara, mucury, ague.

Distribution: Native to Brazil, state of Guanabara (Rio de Janeiro). Campos or open fields.

Cocos weddelliana was originally described by Wendland (1871). No specimens were cited, but Wendland stated that this palm was first discovered by Weddell in 1831 on the southern slopes of Serra dos Orgãos in Brazil, and later by Riedel in 1832 near Macahé. Wendland said that he saw specimens collected by both men. He also stated that plants were introduced into the Belgium Gardens of Ghent by Louis van Houtte about 1860 and later imported by Linden of Brussels and distributed under the name of *Leopoldinia pulchra.* At a later date, *C. weddelliana* appeared under another horticultural name, *Glaziova elegantissima.*

Unaware of Wendland's published description, Glaziou described the same species in Drude (1881) under the name *Glaziova martiana,* but he listed *Cocos weddelliana* H. Wendl. *ex* Hort. (sine description) in synonymy. The following specimens were cited: *Glaziou 288, 2758, 3635, 8051, Burchell 2530,* and *Riedel s.n.* (in 1832). Dahlgren (*pl. 397,* 1959) illustrated *Glaziou 3535* (C) as a type of *Cocos weddelliana,* but several earlier collections are available from which a type can be selected.

Although Wendland cited no specimens in the original publication of *Cocos weddelliana,* he mentioned that he saw collections of Weddell and Riedel. Unfortunately, specimens collected by these two men have not been located in Paris, Leningrad, or any other herbaria. Therefore, I have designated *Lhotsky 8* (G), dated 1832, as the lectotype because it appears to be the oldest available specimen of this species collected from the type locality (Serra dos Orgãos).

Varietas *cinerea* was described by Beccari as differing from var. *weddelliana* by the conspicuous cinereus (ash grey) indument on the pinnae, but both taxa have this characteristic; hence I have reduced var. *cinerea* to synonymy. The other variety listed in synonymy, *pinaertii,* was selected by Sander from seedlings that had very narrow pinnae in a nursery of Pynaert Van Gurt of Ghent. No specimens were cited, but Sander obtained a first class certificate for var. *pinaertii* from the Royal Horticulture Society. Because palms vary considerably under

cultivation, I do not choose to recognize this variety unless further studies are made.

Microcoelum weddellianum is most closely related to *M. insigne,* but it can be distinguished from the latter by the narrower middle series pinnae and the chestnut-brown tomentose rather than blackish-brown tomentose sterile bracts. According to Williams *et al.* (1973), *M. weddellianum* shows a distinct flavonoid pattern compared to the other cocosoid palms surveyed.

Microcoelum weddellianum is sold in florist shops as a popular ornamental house plant and is also commonly cultivated in various botanical gardens (see cited specimens).

Judging from the absence of recent collections of *M. weddellianum* from the state of Guanabara (Rio de Janeiro), this palm is either very rare or it has become extinct in its native habitat.

Microcoelum insigne (Hort. *ex* Drude) Burret & Potztal, Willdenowia 1:388. 1956.

FIGS. 15, 16; PLATE VII, 1; MAP 10.

Glaziova insignis Hort. *ex* Drude *in* Martius, Fl. Brasil. 3:398. 1881; Barb. Rodr., Sertum Palm. Brasil. 1:115. *t. 87B.* 1903.

Cocos insignis (Hort. *ex* Drude) Mart. *ex* Hooker, Kew Report 1882:72. 1884.

Syagrus insignis (Hort. *ex* Drude) Becc., Agric. Colon. 10:467. 1916; Dahlgren, Index Amer. Palms *pl. 391.* 1959.

Lytocaryum insigne (Hort. *ex* Drude) Toledo, Arq. Bot. S. Paulo 2:8. 1944. Lectotype: Brazil, Petropolis, a la Grande Roche de la Mamminha, 1879, *Glaziou 11637* (C). cf. Dahlgren 1959, *pl. 391.*

Plants with trunks 2-3 m tall. Sheathing leaf base 48-51 cm long and 8 cm wide, blackish-brown tomentose on underside; petiole 3-3.5 cm long, margins fibrous; leaf rachis 80-85 cm long, with patches of blackish-brown hairs; pinnae 58-60 on each side, regularly arranged, usually silvery glaucous above and grayish-green below, becoming green with age, or occasionally brownish pubescent, those from mid-section 20-30 cm long and 1.0-1.5 cm wide, mostly with acuminate, asymmetrical tips. Expanded part of sterile bract 51-54 cm long and 4.3 cm wide, sulcate, mostly densely blackish-brown tomentose, becoming glabrous with age; branched part of inflorescence 34-37 cm long, rachillae about 40 in number, occasionally re-

branched, each 17-20 cm long. Staminate flowers 3-5 mm long, petals 2.5 mm wide, with small, reddish dots, anthers 2 mm long; pistillate flowers pyramidal, sepals shorter than petals at anthesis, with scattered whitish ramenta and reddish-brown dots, 3.0-4.5 mm long and 2.5 mm in diameter. Fruit 1.8-2.3 cm long and 1.6-1.7 cm in diameter, mesocarp usually dehiscing along 2 or 3 seams when mature, endocarp fragile, less than 0.5 mm thick, cavity trivittate, smooth. Seed fragile, flattened dorso-ventrally, 1.0-1.2 cm long and 1.2-1.3 cm in diameter, endosperm homogeneous.

Specimens examined. **Brazil.** GUANABARA (RIO DE JANEIRO): without locality, *Glaziou 2757* (FI, MO, P, US); Petropolis, a la Grande Roche de la Mamminha, 1879, *Glaziou 11637* (C, lectotype; G, K, P); Petropolis, Serra dos Orgãos, 1885, *Glaziou 16479* (C, K, LE, P); Santa Ana, 1909, *E. Garbe 6198* (SP); Serra de Macahé, 1909, *E. Garbe 6199* (SP); Serra de Estrela, 1879, *Herb. Saldanha s.n.* (R-5273); Rio de Janeiro, 1879, *Glaziou 11632* (LE). ESPIRITO SANTO: Castelo, Braço do Sul, 1948, *Brade 19307* (RB). Without definite locality, *Glaziou 16482* (K).

CULTIVATED. **Brazil.** São Paulo, Ypiranga, *H. Luederwaldt s.n.* (SP-12271, 24150); Jard. Bot. Rio de Janeiro, 1924, *L. H. Bailey & E. Z. Bailey 613* (BH). **Portugal.** Coimbra, 1887, *Hewiging s.n.* (FI).

Flowering from March to November.

Vernacular names: coquerinho da serra, icá-assú.

Distribution: Native to Brazil, states of Espirito Santo and Guanabara (Rio de Janeiro). Campos or open fields.

Cocos insignis Mart. originally appeared in the literature as a name only, by Wendland in Kerchove (1878). Drude (1881) validated the specific epithet by describing it under *Glaziova;* he did not refer to Wendland but attributed it to cultivated origin. Drude cited the following: Novo Friburgo, prov. Rio de Janeiro, *Glaziou 2757* and *11637.* As both numbers were listed together and no herbaria were specified, and as none of the specimens with these numbers bear the above locality (Novo Friburgo), positive determination of the holotype would be difficult. *Glaziou 11637* (C), consisting of three sheets, was chosen as the lectotype because these specimens were identified by Drude and were also illustrated by Dahlgren (*pl. 391,* 1959). Originally, I considered *Glaziou 2757* (FI, two sheets) as the holotype, but there is no indication that Drude actually saw these specimens, especially since they contain fruits that were not described by Drude in 1881. I have

seen duplicates of this number (MO, P, US), but apparently they were not determined by Drude either.

As previously mentioned, *Microcoelum insigne* forms a natural unit with *Lytocaryum hoehnei* and *M. weddellianum* because their fruits all have a mesocarp that splits into three parts at maturity. *M. insigne* differs from *L. hoehnei* in having homogeneous rather than ruminate endosperm and from *M. weddellianum* in having blackish-brown tomentose rather than brownish tomentose sterile bracts, and in having wider middle pinnae. Like *M. weddellianum,* this palm is probably on the verge of extinction because its native habitats are being destroyed. As a result, very few recent collections have been made.

RHYTICOCOS Becc., Malpighia 1:350. *t. 9, fig. 2.* 1887.

Syagrus sect. *Syagrus* Glassman, Fieldiana Bot. 32:229. 1970 (in part, only *R. amara*). Type species: *Rhyticocos amara* (Jacq.) Becc.

A monotypic genus with description under its species below.

Rhyticocos amara (Jacq.) Becc., Malpighia 1:350. *t. 9, fig. 2.* 1887; L. H. Bailey, Gentes Herb. 4:368. *figs. 231-236.* 1940; Hodge, Principes 1:176. *3 figs.* 1957; Read, Palms Lesser Ant. 3:349. *fig. 72.* 1979.

FIG. 18; PLATE VII, 2.

Cocos amara Jacq., Sel. Stirp. Amer. Hist. 1:277. 1763 ("*amarus*").

Syagrus amara (Jacq.) Mart., Palmet. Orbign. 132. 1844; Hist. Nat. Palm. 2:291. *t. 166, fig. 2.* 1845; Glassman, Fieldiana Bot. 32:229. 1970. Type: "Copiose in Martinicae sylvis densis et montosis." (No specimens cited). Lectotype: Jacquin, p. 277. 1763.

Trees 15-20 m tall, 10-20 cm in diameter (fide Bailey). Sheathing leaf base (often indistinguishable from petiole) 70 cm long and 25 cm wide; petiole 1-1.2 m long and 5 cm wide, margins fibrous, becoming smooth toward apex; complete leaf rachis not seen; pinnae 52-57 on each side, those from mid-section usually in clusters of 2-3, mostly green on both surfaces, 110-117 cm long and 4.2-5 cm wide, mostly with acute, asymmetrical tips. Expanded part of sterile bract 100-104 cm long and 18-21 cm or more wide, sulcate, acuminate tip about 13 cm long; branched part of inflorescence about 70 cm or more long, rachillae about 50 in number, each 50-56 cm long. Staminate

flowers 10-13 mm long on proximal part of rachilla and 7-10 mm long on distal part, petals 2.5 mm wide, anthers 5 mm long; pistillate flowers pyramidal, sepals longer than petals at anthesis, both distinctly nerved, 10-13 mm long and 9-11 mm in diameter, part of style and ovary whitish-tomentose. Mature fruit orange, ovoid-oblong, 5-7 cm long and 3.5 cm in diameter, short beak, endocarp bony, 2-4 mm thick along sides and 5-6 mm thick at extremities, cavity trivittate, smooth and slightly irregular. Seed globose or ovoid, about 3 cm long and 2.5 cm in diameter, endosperm ruminate.

Specimens examined. **Martinique.** without locality, 1882, *Pere Duss 18* (F, FI, US). **Dominica.** Hampstead, 1903, *F. E. Lloyd 675* (NY); coastal forest, east of Dublanc, 1940, bluffs at Salyba, 1940, moist forests in valley of Hampstead River, 1940, *W. H. & B. T. Hodge 2514, 3361, 3699* (GH). **Guadeloupe.** St. Rose, 1937, *A. Questel 613* (P).

CULTIVATED. **Montserrat.** Waterwork Lab, 1891, *J. S. Hollings s.n.* (K). **Trinidad.** 1924, *W. E. Broadway s.n.* (F), *Dahlgren s.n.* (F-611128). **Java.** *Hort. Bot. Bog. V. J. 14* (FI). **United States.** FLORIDA: Miami, Chapman Field, 1965, *Read 1415* (FAIR).

Flowering from March to July, and rarely January (fide Pere Duss).

Vernacular names: petit coco (Martinique); mocho, moca palm (Montserrat); coco nain, yattahou (Dominica); petit coco de bois (Guadeloupe); overtop palm (fide L. H. Bailey). Read (1979) lists additional names.

Distribution: Native to central volcanic isles of the Lesser Antilles (Martinique, Dominica, Guadeloupe, Montserrat, and St. Lucia) and Trinidad. Dry coastal forests (fide Read, 1979).

Rhyticocos amara is the only genus in the *Syagrus* unit that occurs in the native state outside of the South American continent. It appears to be a distinct taxon with no close living relatives. According to H. E. Moore (1963a), *R. amara* is most closely related to *Chrysallidosperma smithii* and *Barbosa pseudococos* because all three taxa have ruminate endosperm. Ruminate endosperm seems to have arisen independently in several more or less distantly related taxa in the *Syagrus* unit (the three genera mentioned above plus *Lytocaryum hoehnei* and *Arikuryroba schizophylla*). Other characteristics are important in determining relationships of *R. amara.* It may be more closely allied to *Syagrus orinocensis* and *S. inajai* because of the similar leaf anatomy patterns.

According to Hodge (1957) the seeds of *R. amara* contain a "milk" that is bitter, especially in the immature stages. In the past, fermented

drinks were made from the fruits and terminal buds of this palm in the islands where it is native.

Taxonomic Treatment of Genera in *Cocos* and *Jubaea* Units

COCOS L., Sp. Pl., 1188. 1753. Type species: *Cocos nucifera* L.
A monotypic genus with description under its species below.

Cocos nucifera L., Sp. Pl., 1188. 1753; H. E. Moore, Gentes Herb. 11: *fig. 37.* 1973; Moore & Fosberg, Gentes Herb. 8: *fig. 138.* 1956. Lectotype: *Tenga* Rheede, Hort. Ind. Malabar. 1:1. *pl. 1-4.* 1678-1703. cf. Moore & Dransfield p. 64, *fig. 5.* 1979.

Trees 18-24 m tall, 40-60 cm in diameter, old petiole bases abscissing completely to form clean scars on trunk. Leaves averaging 28-30 per tree, sheathing bases fine network of fibers; petiole 0.9-1.5 m long, margins smooth; leaf rachis 4.5-6 m long; pinnae 75-90 on each side, regularly arranged, those from mid-section 60-90 cm long and about 3.5 cm wide, mostly with acuminate, symmetrical tips. Expanded part of sterile bract 90-120 cm long and 15-20 cm wide, sulcate, usually glaucous; inflorescence 90-120 cm long, rachillae numerous (more than 100), each 30-40 cm long. Flowers arranged in 1-2 triads of two staminate flowers and one pistillate flower at base of rachilla, single or paired staminate flowers above. Staminate flowers 12-15 mm long, with 3 valvate petals and 3 much smaller imbricate sepals (about ¼ as long), stamens 6, filaments erect, anthers oblong, sagittate at base; pistillate flowers subglobose, about 25 mm long and 25 mm in diameter, with 3 imbricate, rounded sepals and 3 petals, staminode united in a low, disk-like ring at base of globose ovary. Fruit averaging 20-30 cm long and about 12-18 cm in diameter, often angled, epicarp smooth, mesocarp fibrous and very thick, endocarp bony, relatively thin, bearing 3 pores at base and tightly adherent to seed. Seed about ½ as large as fruit, endosperm homogeneous, with very large central cavity usually filled with clear fluid.

Flowering during most months of the year.

Vernacular name: coconut.

Distribution: Pantropical in cultivation. In the Pacific islands, optimal growth occurs along the strand in sandy or coral soils. Many varieties have a shallow root system, capable of growing on thin soil over coral, and have the ability to exploit fresh water lenses. Other

varieties grow on deeper cultivated soils with loam, especially in southeast Asia (Harries, 1978), frequently escaping cultivation and becoming an established part of the vegetation. Thought to be native to Palmyra Island, an uninhabited coral atoll at the time of its discovery (Beccari, 1963). Cook (1963) postulated New World (South American) origin, whereas Beccari (1963) claimed an Old World (Asiatic or Polynesian) origin for the coconut; recent evidence indicates a Melanesian origin (H. E. Moore, 1973). The bulk of evidence seems to overwhelmingly support the Old World rather than New World origin.

As there apparently are no collections of particular historical significance and because the coconut is commonly cultivated, no specimens have been cited here. However, many specimens of *Cocos nucifera* are deposited in the Field Museum and other large herbaria.

Coconut is probably the best known, the most important economically, and the most widely distributed of all palms. According to Stevenson (1974), approximately 80 named varieties of coconut have been published. All varieties, except a few, are being threatened by a lethal yellowing disease, which already has decimated populations of coconut palms in various parts of the tropics. Articles pertaining to *Cocos nucifera* are too numerous to cite here, but as an example, Moore & Fosberg (1956) have listed about 40 papers dealing with the coconut in Micronesia alone. Other significant works of general interest include Child (1974) and Harries (1978).

In coconut, there are normally triads of staminate and pistillate flowers on the same inflorescence, but intermediates between hermaphroditism and monoecism, and between monoecism and dioecism, have been reported by Davis *et al.* (1954), Gopaul Rao (1948), and John and Narayana (1942).

According to Bondar (1939), coconut cultivation is most productive along the Atlantic coast of Brazil, especially in the states of Bahia, Alagoas, Pernambuco, and Sergipe.

In the past, the genus *Cocos* has served as a "dumping ground" for many species of cocosoid palms of uncertain affinities. More than 90 species and several varieties, mainly in *Syagrus,* have been described under or have been transferred to this genus (Glassman, 1972b). The segregation of *Cocos* as a monotypic genus from other allied genera (e.g., *Arecastrum, Arikuryroba, Barbosa, Butia, Syagrus, Rhyticocos*) was implemented primarily by Beccari (1887, 1888, 1916). Morphologically, *Cocos nucifera* is a distinct taxon, probably with few close relatives

(see key characters). According to Williams *et al.* (1973), coconut has a distinct flavonoid pattern compared to other palms surveyed. Its leaf anatomy pattern, however, resembles several species of *Syagrus* and *Arecastrum romanzoffianum.*

JUBAEA H.B.K., Nov. Gen. Sp. Pl. 1:308. *t. 96.* 1816. Type species: *Jubaea chilensis* (Molina) Baillon.

A monotypic genus with description under its species below.

Jubaea chilensis (Molina) Baillon, Hist. Pl. 13:397. 1895.

FIG. 19; MAP 11.

Palma chilensis Molina, Saggio sulla Storia Naturale del Chile 180. 1782.

Cocos chilensis (Molina) H.B.K., Nov. Gen. Sp. Pl. 1:309. 1816.

Micrococos chilensis (Molina) Philippi, Bot. Zeit. 17:362. 1859. Type: Chile (no specimens cited). Lectotype: Molina, p. 180, 1782.

Jubaea spectabilis H.B.K., Nov. Gen. Sp. Pl. 1:308. *t. 96.* 1816; Gaudichaud, *pl. 31.* 1841-52; Dahlgren, Index Amer. Palms *pl. 316.* 1959. Type: Chile, in garden near Popayan, Humboldt and Bonpland (P, destroyed?). cf. Dahlgren 1936, p. 196. Lectotype: H.B.K., *t. 96.* 1816.

Molinaea micrococos Bertero *in* Baillon, Hist. Pl. 13:397. 1895. Lectotype: Chile, *Bertero s.n.* (M). cf. Dahlgren 1959, *pl. 316.*

Trees 19-34 m tall, as much as 1 m in diameter, petiole bases completely abscissing from trunk, only leaf scars remaining. Leaf sheath and petiole about 0.5 m long, petiole margins smooth or fibrous; leaf rachis 1.5-2.5 m long; pinnae about 120 on each side, mostly in clusters of 2-5, those from mid-section 30-46 cm long, 2.5-3 cm wide, with acuminate, symmetrical tips. Sterile bracts about 1.25 m long, smooth or striate, light brown tomentose, becoming glabrous with age; inflorescences with about 100 rachillae, 30-60 cm long, maroon in color; flowers arranged on rachilla in triads of two staminate and one pistillate on proximal third, and staminate flowers only on distal two-thirds. Staminate flowers 10-14 mm long, including pseudopedicel (up to 5 mm long), petals 8-9 mm long, 5 mm wide, maroon in color, sepals 3-4 mm long, stamens 15-30 in number, yellow in color, anthers about 3 mm long, filaments about 4 mm long; pistillate flowers ovoid-globose, about 7 mm long and 9-10 mm in diameter,

deep maroon in color, sepals and petals strongly nerved, about equal in size at anthesis, strongly imbricate, pistil about 5 mm long and 5 mm in diameter, with 3 indistinct stigmas, ovary wrinkled, 3-locular, 2 locules rudimentary. Mature fruit globose-turbinate, orange, 3.4-4.1 cm long and 3.0-3.8 cm in diameter, epicarp and mesocarp relatively thin, endocarp 2-3 mm thick, pores located at or near middle of fruit. Seed usually one (rarely two), globose, about 2 cm long and 2 cm in diameter.

Specimens examined. **Chile.** VALPARAISO: vicinity of El Salto, near Valparaiso, on decomposed granitic soils, dry hillsides and ravines, 1965, *H. E. Moore 9366* (GH).

CULTIVATED. **United States.** CALIFORNIA: Huntington Gardens, *9186* (F)—without collector's name (immature fruits). **England.** Royal Botanic Gardens, Kew, tree about 30 m tall, growing in Temperate House, Sept. 1981 (mature fruit), *Glassman s.n.* (CHI).

Flowering in November.

Vernacular names: coquito, Chilean wine palm, honey palm.

Distribution: Endemic to Chile (32°-36°S), from Los Vilos in northern part of Province Aconcagua to Itala. Limited to the coastal range from sea level to a few 100 m alt. According to Reiche (1907), some of the thickest stands were found in the provinces of Aconcagua (northwest of Petorea), Valparaiso (Ocoa), O'Higgins (Cocolan), and Curico. The most extensive stands (of about 200,000 trees) were in Ocoa and Cocolan. Reiche (1907) characterized this palm as a xerophyte, growing in the Bacchares-Lithrea-Schinus formation. He also stated that *Jubaea* can be cultivated as far south as 37°, but it does not produce ripe fruits at this latitude. Unquestionably, *Jubaea* is much less common today than a century or so ago. In 1832, Darwin reported seeing several hundred thousand trees near Valparaiso, but 50 years later only a few hundred trees were left. According to H. E. Moore (1977), stands of this species today have been reduced to five populations, from Cuesta Las Palmas in the north to El Almacigo in the south. Countless trees have been destroyed to extract the sap for honey, wine, and canned syrup.

No specimens were cited in the original article by Molina. It appears from the original publication of H.B.K. that Humboldt and Bonpland made a collection of *Jubaea* from a garden in Chile, but I have not seen any specimens with this data from the Paris herbarium where most of their collections are deposited.

Although *J. chilensis* does not appear to have any close relatives, its affinities seem to be with the genus *Butia* (especially *B. yatay* and *B. capitata*). Both genera have smooth or striate spathes, embryo pores located near middle of fruit, and a similar leaf anatomy pattern. Chemotaxonomic studies by Williams *et al.* (1973) also corroborate the apparent close affinities. The main differences between the two genera are in the numbers of stamens per flower and the margins of petioles. *Jubaea* has 15-30 stamens and smooth petiole margins, whereas *Butia* has only 6 stamens in all species, and dentate petiole margins in 5 of the 8 species.

According to Saakov (1963), *Jubaea* is cultivated along the Black Sea Coast. During the cold winter of 1949-50, trees in the Nikitsky Botanical Garden (Crimea) lost all of their leaves, but new ones developed during the summer of 1950.

JUBAEOPSIS Becc., Webbia 4:171. 1913. Type species: *Jubaeopsis caffra* Becc. A monotypic genus with description under its species below.

Jubaeopsis caffra Becc., Webbia 4:173. *figs. 4-5.* 1913; Wicht, Indig. Palms. S. Africa, p. 34. 1969.

FIGS. 14, 20.

Lectotype: South Africa, East Pondoland, Umsikaba (Msikaba) and Mtentu rivers, *Charles Ross s.n.* (K).

Trees 5-8 m tall, 24-30 cm in diameter, trunks usually clustered, each dividing at crown level (fide Barry, 1957) or suckering from trunk at ground level (Robertson, 1977b). Leaves 3.5-4.5 m long, division between sheathing base and petiole obscure; petiole margins fibrous or smooth; pinnae regularly arranged, those from mid-section 80-85 cm long and 3.0-3.3 cm wide, with acute, asymmetrical tips. Sterile bracts (size not recorded) more or less smooth or striate, woody, 2-3 mm thick; inflorescence (size not recorded) with many rachillae, each 71-82 cm long; flowers arranged on rachilla in triads of two staminate and one pistillate on proximal part and only staminate flowers on distal part. Staminate flowers 12-20 mm long and 5-6 mm wide, petals valvate, sepals separate, 3-4 mm long, stamens 8-16 in number; pistillate flowers ovoid, 8-10 mm long and 5-7 mm in diameter, sepals and petals about equal in size, strongly imbricate. Mature fruit globose, slightly turbinate, 2.8-3.1 cm long and 3.0-3.2 cm

in diameter, epicarp and mesocarp relatively thin, fibrous, endocarp bony, 3-5 mm thick, cavity conforming to shape of seed, embryo pores located at or near middle of fruit. Seed globose-turbinate, 2.2 cm long and 2.2 cm in diameter, cavity rather large, 1.3 cm long and 1.3 cm wide, sometimes filled with fluid, endosperm homogeneous.

Specimens examined. **South Africa.** E. Pondoland, Umsikaba and Mtentu rivers, 1909, *Charles Ross s.n.* (K, lectotype); Pondoland, 1898, *Booker s.n.* (K); N. Pondoland, Um-Teentu River, 1915, *J. Burtt Davy 15302* (K).

CULTIVATED. **United States.** FLORIDA: Miami, Fairchild Tropical Garden, 1977, *S. Kiem 10421* (CHI)—leaf only.

Flowering from March to November.

Vernacular names: inkomba, dwarf coconut.

Distribution: South Africa, region of East Pondoland in Transkei. Known only from the north banks of the two rivers mentioned above, about five miles apart.

In his original description, Beccari mentioned the collections of Charles Ross and others but did not cite any specimens. Therefore, I have designated the above specimens (collected by Charles Ross) as lectotype.

According to Wicht (1969), this palm is seldom cultivated in South Africa (only two botanical gardens, one of which is St. Georges Park, Port Elizabeth) or elsewhere. Barry (1957) reports that the seeds are eaten by baboons in areas where this species grows. He planted several seeds of *Jubaeopsis* in southern California but only a small percentage germinated and reached maturity. Barry also noted that the hypocotyl must descend 18 inches below the soil surface before the upper part of the seedling will develop and emerge. For this reason he could not grow them in shallow pots. Robertson discussed the morphology and development of fruit and seed (1977a) and the vegetative morphology (1977b) of *Jubaeopsis.*

According to Beccari (1913), this genus is most closely related to *Jubaea* from Chile. When it was originally described, Beccari tentatively considered placing *Jubaeopsis* in *Jubaea* as a second species. There are, however, distinct differences by which the two genera can be separated. After comparing the leaf anatomy and flavonoid patterns of both genera, I have concluded that they are not as closely related as Beccari presumed. As previously mentioned, *Jubaea* appears to be

more closely allied to species of *Butia* than to *Jubaeopsis.* Table 5 shows similarities and differences between *Jubaea, Butia,* and *Jubaeopsis.*

Hybrids Involving Genera in *Syagrus* Unit Besides *Syagrus*

As previously mentioned, some members of the *Syagrus* unit are involved in hybridization. *Arikuryroba schizophylla* crosses with *Syagrus coronata* to produce *Syagrus* × *tostana;* and *Arecastrum romanzoffianum* hybridizes with *Syagrus coronata* and *S. oleracea* to yield *S.* × *camposportoana* and *S.* × *teixeiriana,* respectively, and with *Butia capitata* to produce × *Butiarecastrum nabonnandii.* The three hybrids involving *Syagrus* were included in the revision of genus *Syagrus,* but × *Butiarecastrum* is treated below.

× Butiarecastrum nabonnandii Robertson-Proschowsky, Rev. Hort. 93:290. *fig.* 1921. cf. H. E. Moore, Principes 26:50. 1982.

PLATE VI, 1.

Type: (no specimens cited).

Syagrus × *fairchildensis* Glassman, Principes 15:82. *figs. 6-10.* 1971. Holotype: cult. Fairchild Tropical Garden, Miami, Fla., *Glassman 8764* (CHI).

Tree 6-7 m tall, sheathing leaf bases and petiole bases persistent along most of length of trunk. Dividing line between sheathing leaf base and petiole indistinct; sheathing leaf base about 27 cm long and 17 cm wide, margins armed with soft fibers only or soft fibers intermixed with stiff, spine-like fibers; petiole 108 cm long, about 8 cm wide near base and 2.5-3.0 cm near apex, margins with spine-like fibers near base, fibers gradually becoming smaller and dentate up to apex; leaf rachis 253-293 cm long; pinnae 105-113 on each side, mostly regularly arranged, slightly glaucous on both surfaces, those from mid-section 106 cm long and 2.5 cm wide, mostly with acute, asymmetrical tips. Expanded part of sterile bract 121-156 cm long, 14.5-17.0 cm wide and 2-3 mm thick, mostly sulcate, but depth of grooves variable; branched part of inflorescence 94-151 cm long, peduncle 82 cm long, rachillae about 127 or more in number, each 67-77 cm long. Staminate flowers 10-13 mm long proximally and 6-9 mm long distally; petals 2 mm wide, with reddish punctate glands,

anthers 3-3.5 mm long; pistillate flowers ovoid or rounded, sepals longer than petals at anthesis, both distinctly nerved, 5-7 mm long and 4.0-4.5 mm in diameter. Fruit broadly ovoid, 1.5-2.1 cm long and 1.3-1.6 cm in diameter, short beak, endocarp 2-6 mm thick, locules 1-2, cavities slightly irregular to very irregular in shape. Seeds conforming to shape of cavities, easily separating from them, ovoid and slightly irregular to very irregular and uncinate in shape, 0.4-0.9 cm long and 0.2-0.8 cm in diameter, endosperm homogeneous.

Specimens examined. CULTIVATED. **United States.** FLORIDA: Fairchild Tropical Garden, Miami, plot 111, no. FG-60-754A, *Glassman 8764* (CHI, holotype of *S.* × *fairchildensis*); Fairchild Tropical Garden, Miami, plot 111, no. FG-60-754B, *Glassman 8765* (CHI, paratype).

Flowering in March.

Vernacular names: none recorded.

Distribution: Known only from cultivation, especially in Florida.

Both plants cited above originally came from the Florida Nursery and Landscape Co., Leesburg, Florida, and were planted in the Fairchild Tropical Garden during November 1960, when they were about 1.5 m tall. According to Eric Golby (personal communication), the first artificial hybrids between *Butia capitata* and *Arecastrum romanzoffianum* were made by Reasoner's Tropical Nurseries in the early 1900's. Other hybrids between these two species were perpetuated in various nurseries on Florida's west coast until recent years when the land was sold for other enterprises.

Seeds of this hybrid are apparently sterile; no developed embryos could be found when several sectioned fruits were examined. Inspection of 5,000 pollen grains from 10 different staminate flowers revealed that less than 5 percent were fertile.

A chart showing similarities and differences between the hybrid and its two parent species is tabulated in Glassman (1971c).

Anatomically, the hybrid resembles *A. romanzoffianum* in the shape of the midrib and *B. capitata* in the attachment of the nonvascular fibers to smaller veins from both sides, but other characters, such as laminar surfaces, seem to be intermediate between both parent species.

In recent flavonoid studies (Williams *et al.*, 1983), the hybrid differs from each parent species by three compounds, and two of these (isorhamnetin and kaemferol) are not found in either parent.

Syagrus × *fairchildensis* was described at a time when I considered

Table 5. Comparison of *Jubaea, Butia,* and *Jubaeopsis*

	Jubaea	*Butia*	*Jubaeopsis*
Trunk			
Height and habit	30-34 m, not caespitose	without trunk, or up to 12 m, not caespitose	5-6 m, usually caespitose
Leaf			
Petiole margins	smooth or fibrous	armed with spines or fibrous	smooth or fibrous
Pinnae from mid-section			
Arrangement	clusters of 2-5	regularly arranged	regularly arranged
Length × width	30-46 × 2.5-3 cm	26-80 × 0.4-2.5 cm	80-85 cm × 3.0-3.3 cm
Sterile bract			
Exterior	smooth or striate	smooth or striate	smooth or striate
Rachillae			
Length and color	30-60 cm, maroon	6-60 cm, greenish or purplish	71-82 cm, greenish-brown
Pistillate flowers			
Length × diameter and color	7 × 9-10 mm, maroon	3-16 × 3.5-10 mm, cream or purplish	8-10 × 5-7 mm, cream
Staminate flowers			
Length and color	10-14 mm, maroon	4-13 mm, cream or purplish	12-20 mm, cream
Stamen number	15-30	6	8-16

Fruit			
Length × diameter	*3.4-4.1 × 3.0-3.8 cm*	*1.8-4.2 × 1.0-2.8 cm*	*2.8-3.1 × 3.0-3.2 cm*
Location of embryo pores	*at or near middle of fruit*	*usually near middle, sometimes near base*	*at or near middle of fruit*
Leaf anatomy	*NVF* common on both adaxial and abaxial sides,* attached to single medium veins from both sides and separate smaller veins from both sides	*same arrangement as Jubaea*	*NVF* common adaxially,* either separate or attached to adaxial sides of veins, NVF* absent abaxially
Distribution	Endemic to Chile between 32°-36°S along coastal range near sea level	Most states in southern half of Brazil, Paraguay, Uruguay, and northern Argentina	Endemic to East Pondoland, South Africa, only from the banks of two rivers

* NVF = nonvascular fibers

both parent genera to be part of the genus *Syagrus.* I had seen no authentic specimens until I visited the Fairchild Tropical Garden. It seems proper to accept this overlooked name (× *Butiarecastrum nabonnandii*) because *Butia, Arecastrum,* and *Syagrus* are now treated as distinct genera.

Excluded Species in *Syagrus* and *Cocos* Units

Arecastrum romanzoffianum var. *botryophorum* (Mart.) Becc., Agric. Colon. 10:456. 1916. = Syagrus botryophora (Mart.) Mart.

A. romanzoffianum var. *ensifolium* (Drude) Becc., *ibid.* 459. 1916. = Syagrus coronata (Mart.) Becc.?

Arikuryroba ruschiana (Bondar) Toledo, Arq. Bot. S. Paulo 2:6. 1944. = Syagrus ruschiana (Bondar) Glassman.

Barbosa getuliana (Bondar) Hawkes, Arq. Bot. S. Paulo 2:177. 1952. = Syagrus sp. *Species incerta.*

Cocos. As previously mentioned under the taxonomic treatment of *Cocos nucifera,* more than 90 specific and varietal names have been published under genus *Cocos* (Glassman, 1972b) which have been transferred to other genera.

Systematic Leaf Anatomy Studies

The most comprehensive leaf anatomical survey of palms was made by Tomlinson (1961), who examined 250 species in 137 different genera, including 12 genera and 13 species in the *Cocos* alliance. Several years later, I completed an anatomical study (Glassman, 1972a) covering 51 taxa in the genus *Syagrus, sensu lato.* At the time, I considered *Syagrus* to include members of the *Butia* unit (genus *Butia*) and all genera in the *Syagrus* unit (*Arecastrum, Arikuryroba, Barbosa, Chrysallidosperma, Lytocaryum, Microcoelum, Rhyticocos,* and *Syagrus*). As indicated previously, these taxa have since been separated from *Syagrus* and are now treated as separate genera. Systematic leaf anatomy also has been used to show relationships between several species of *Syagrus* in Bahia (Glassman, 1978b) and between species of *Butia* (Glassman, 1979).

A total of 50 species (including illustrations for each) in 13 different genera are treated in the present survey. Several species of *Syagrus* covered in my earlier study (Glassman, 1972a) have been reduced to synonymy, and a number of genera and species in the present paper were not treated in the previous article.

Material was obtained from the widest pinnae on the leaf of dried herbarium specimens (vouchers are included in the list of illustrations). Slides of two or more specimens were made for most species. With few exceptions, only one voucher specimen for each species is cited here. Portions of each pinna were embedded in JB-4 plastic as described in Polysciences (1981). Cross sections were cut with a sliding microtome at 5-10 microns and stained with aqueous safranin and fast green in 90% alcohol. Most of these procedures are described in greater detail in Glassman (1972a) and in Polysciences (1981).

Anatomical criteria used to distinguish taxa and a key to species were elaborated in Glassman (1972a). This information plus additional

data is included in the keys which follow. Several significant results have emerged from these studies: 1. It is possible to distinguish most species solely on the basis of pinnae cross sections and thus be able to construct a key. 2. By combining anatomical, morphological, and sometimes chemotaxonomical data, it is often possible to devise a more meaningful scheme of classification than by use of morphology alone. Leaf anatomy furnishes additional information that usually helps to clarify uncertain relationships and to corroborate known relationships between genera and species. 3. In some instances, anatomically similar taxa are quite different morphologically, and conversely, morphologically similar species are dissimilar anatomically. 4. Most of the hybrids studied show more or less intermediate characteristics between parent species. 5. Anatomical data also enabled me to reduce or elevate certain questionable species, especially those known from incomplete herbarium material. More detailed information regarding anatomical relationships was discussed under taxonomic treatment of each species.

Plate and figure numbers are listed in parentheses after each species name in the keys.

Key to Species of Genus *Syagrus* Based on Leaf Anatomy

1. NVF (nonvascular fibers) attached to either single medium veins or separate small veins from both adaxial and abaxial leaf surfaces, veins usually in or near middle of mesophyll.
   2. NVF attached only to separate small veins from both leaf surfaces and to large veins from adaxial surface.
      3. Some patches of NVF not attached to medium and small veins, medium veins about same size or slightly larger than small veins.
         4. NVF attached to small veins as short strands, also separately as round patches in about equal numbers ..... *S. lilliputiana* (pl.I,6).
         4. NVF mostly attached to small veins as short strands, occasionally occurring separately as round patches ..... *S. graminifolia* (pl.I,5).
      3. All patches of NVF attached to medium and small veins, most medium veins 3-4X larger than small veins ..... *S. leptospatha* (pl.I,2).

2. NVF usually attached to single medium veins from both leaf surfaces, frequently attached also to separate small veins, and to large veins from adaxial surface.
   5. Lamina deeply furrowed on both surfaces; NVF attached to single medium veins and to separate small veins from both surfaces..... *S. campicola* (pl.I,1).
   5. Laminar surfaces more or less straight on both surfaces; NVF attached to single medium veins from both surfaces, attached to small veins on abaxial surface only ..... *S. campylospatha* (pl.I,3-4).

1. NVF not attached to medium and small veins from both adaxial and abaxial leaf surfaces, these veins usually in abaxial half of mesophyll.
   6. NVF uncommon (approximately one patch for every two or three veins) adaxially, uncommon or absent abaxially.
      7. NVF on adaxial side only.
         8. ECT (expansion cell tissue) arranged in one unit, covering an area almost twice that of MVB (main vascular bundle)..... *S. loefgrenii* (pl.IV,1-2).
         8. ECT divided into two parts, covering an area about one-half that of MVB ..... *S. cardenasii* (pl.IV,3-4).
      7. NVF on both adaxial and abaxial sides.
         9. Transection of midrib rounded; laminar surfaces wavy on both sides.....*S. macrocarpa* (pl.IV,5-6).
         9. Transection of midrib truncate; laminar surfaces more or less straight on both sides..... ..... *S. cocoides* (pl.XIII,3-4).
   6. NVF abundant or common (approximately 1-2 patches for each vein) adaxially; common, uncommon, or absent abaxially.
      10. NVF abundant or common both adaxially and abaxially.
         11. NVF mostly attached to medium and smaller veins from abaxial side.
            12. Clusters of adaxial NVF usually as large or larger than medium veins..*S. coronata* (pl.VII,3).
            12. Clusters of adaxial NVF usually much smaller than medium veins.....*S. acaulis* (pl.VII,1-2).

11. NVF not usually attached to medium and small veins from abaxial side.
    13. NVF in long vertical strands on adaxial side, mostly in smaller rounded patches on abaxial side.
        14. Hypodermis with 2-3 layers on adaxial surface.
            15. ECT divided into two, combined area equal to or greater than MVB; adaxial NVF unequal in size; medium veins about 2X larger than smaller veins, on different levels..... ..... *S. harleyi* (pl.II,6).
            15. ECT undivided, covering area less than that of MVB, adaxial NVF more or less uniform in size; small and medium veins about the same size, on the same level . *S. vagans* (pl.II,3).
        14. Hypodermis with 1-2 layers on adaxial surface.
            16. ECT divided into two, hypodermis with one layer, cutin layer thin on adaxial surface; medium and small veins about equal in size ..... *S. ruschiana* (pl.II,2).
            16. ECT mostly undivided, hypodermis with two layers, cutin layer thick on adaxial surface, medium veins about 2-3X as large as small veins.
                17. Adaxial hypodermal layers almost entirely thick walled sclerenchyma cells; adaxial NVF strands about 5-6X larger than abaxial NVF; medium veins about 2X larger than smaller veins..... ..... *S. microphylla* (pl.II,5).
                17. Adaxial hypodermal layers almost entirely thin walled parenchyma cells; adaxial NVF strands about 3-4X larger than abaxial NVF; medium veins about 3X larger than smaller veins..... ..... *S. werdermannii* (pl.II,4).
    13. NVF mostly in rounded, similar-sized patches on both adaxial and abaxial sides.....*S. stratincola* (pl.VI,7-8).
10. NVF abundant or common adaxially, uncommon or absent abaxially.

18. NVF absent on abaxial side.
    19. ECT divided into two parts, covering more than twice the area of MVB, containing many conspicuous clusters of fibers; patches of NVF unequal in size .... *S. duartei* (pl.V,3-4).
    19. ECT undivided, covering about the same area as MVB, without conspicuous clusters of fibers; patches of NVF more or less equal in size .....*S. flexuosa* (pl.VIII,3-4).
18. NVF uncommon on abaxial side.
    20. ECT mostly divided into two parts.
        21. Patches of adaxial NVF more or less equal in size and shape, size differences mostly slight.
            22. ECT covering an area greater than MVB, containing many conspicuous clusters of fibers; small and medium veins on 2 or 3 levels, more numerous than patches of adaxial NVF ....*S. glaucescens* (pl.V,5-6).
            22. ECT covering an area about one-half that of MVB, without conspicuous clusters of fibers; small and medium veins usually fewer in number than patches of adaxial NVF..... .....*S. comosa* (pl.V,2).
        21. Patches of adaxial NVF mostly unequal in size and shape, some patches 2-3X larger than others.
            23. Patches of adaxial NVF about 2X as common as medium and small veins; veins more or less equal in size .....*S. oleracea* (pl.VIII,1-2).
            23. Patches of adaxial NVF about as common or slightly more common than medium and small veins; veins unequal in size..... .....*S. petraea* (pl.VII,4-5).
    20. ECT in a single unit.
        24. Transection of midrib more or less pointed or rounded.
            25. MVB filling most of midrib, elliptic in shape; adaxial NVF in long, narrow, horizontal strands, occasionally in small round patches ....*S. sancona* (pl.VIII,5-6).

25. MVB filling about one-third to three-fifths of midrib, ovate in shape; adaxial NVF mostly in round patches or short vertical strands.
    26. MVB filling about one-third of midrib, accompanied by other vascular bundles of decreasing size; lamina more or less straight on both surfaces ..... *S. pleioclada* (pl.III,1-2).
    26. MVB filling about three-fifths of midrib, accompanied by other vascular bundles abruptly smaller in size; lamina very wavy on both surfaces ..... *S. mendanhensis* (pl.III,3-4).

24. Transection of midrib more or less flattened or angular.
    27. Adaxial NVF in small round clusters, more or less uniform in size, about 2X as common as medium and small veins.
        28. Adaxial NVF mostly irregularly distributed in hypodermis, few patches touching epidermis..... *S. botryophora* (pl.XIII,1-2).
        28. Adaxial NVF mostly regularly distributed in hypodermis, most patches touching epidermis..... *S. inajai* (pl.VI,3-4).
    27. Adaxial NVF in round clusters or short strands, mostly irregular in size, about 3X as common as medium and small veins..... *S. orinocensis* (pl.VI,5-6).

Key to *Syagrus* Unit (Except *Syagrus*) Based on Leaf Anatomy

1. NVF usually attached to some veins adaxially, absent abaxially.
    2. Both patches of ECT covering area about 2X the size of MVB; laminar surfaces lobed at location of larger veins ..... *Lytocaryum hoehnei* (pl.IX,5-6).
    2. Both patches of ECT covering area about ½ size of MVB or 1½X larger than MVB; laminar surfaces more or less wavy or notched, not lobed.
        3. Transection of midrib broadly rounded; MVB broadly ovate, abruptly pointed at base; ECT about ½ the size of MVB..... *Microcoelum insigne* (pl.IX,1-2).

3. Transection of midrib narrowly rounded; MVB narrowly ovate, gradually narrowed at base; ECT about 1½X larger than MVB..... *Microcoelum weddellianum* (pl.IX,3-4).

1. NVF usually not attached to veins adaxially, occasional, frequent, or common abaxially, mostly in round patches.
   4. NVF abundant adaxially, in long narrow vertical strands, common abaxially, approximately two patches for each vein ..... *Arikuryroba schizophylla* (pl.II,1).
   4. NVF abundant or common adaxially, mostly in round or irregular patches, or short vertical strands, occasional or frequent abaxially.
      5. Adaxial NVF in short broad vertical strands, about ⅔ the size of small veins or larger.
         6. Abaxial NVF frequent, approximately one patch alternates with each vein..... *Rhyticocos amara* (pl.XI,3-4).
         6. Abaxial NVF occasional, small, one patch alternates with every two or three veins ..... *Arecastrum romanzoffianum* (pl.V,1).
      5. Adaxial NVF in round or irregular patches, about ⅓ the size of small veins.
         7. Adaxial NVF mostly in irregular squared-off patches ..... *Chrysallidosperma smithii* (pl.VI,1-2).
         7. Adaxial NVF mostly in round patches..... *Barbosa pseudococos* (pl.VIII,7-8).

Key to Other Selected Genera in *Cocos* Alliance Based on Leaf Anatomy

1. NVF common adaxially and abaxially, attached to some or most veins from both sides.
   2. NVF attached to almost all veins from adaxial and abaxial leaf surfaces, clusters of NVF mostly round on both sides ..... *Jubaea chilensis* (pl.X,1-2).
   2. NVF attached to about one-third of veins from adaxial and abaxial leaf surfaces, clusters of NVF round on abaxial side, mostly in oval and irregular horizontal patches on adaxial side ..... *Allagoptera campestris* (pl.XI,5-6).

1. NVF common adaxially, uncommon or absent abaxially, attached to some veins on adaxial side.
   3. Abaxial NVF absent, adaxial NVF attached to some veins; transection of midrib pointed.....*Jubaeopsis caffra* (pl.X,3-5).
   3. Abaxial NVF uncommon, adaxial NVF not usually attached to veins; transection of midrib flattened and irregularly angular..... *Cocos nucifera* (pl.XI,1-2).

Literature Cited

Baez, J. R. 1933. Noticia sobre la Distribucion de las Palmeras en la Flora de Entre Rios. Mem. Mus. Paraná (Argentina) Bot. 5:3-11.

Bailey, L. H. 1930. Binomials of certain palms (*Guilielma, Arikuryroba*). Gentes Herb. 2:196.

_____. 1940. Several palm problems. Gentes Herb. 4:357-388.

Barbosa Rodrigues, J. 1875. Enumeratio Palmarum Novarum quas Valle Fluminis Amazonum inventas et ad sertum Palmarum, pp. 1-43. Rio de Janeiro.

_____. 1879. Protesto-Appendice ao Enumeratio Palmarum Novarum, pp. 45-48. Rio de Janeiro.

_____. 1882. Les Palmiers: Observations sur la monographie de cette famille dans la Flora Brasiliensis, pp. 1-53. Rio de Janeiro.

_____. 1888. Palmae Amazonenses novae. Vellosia 1:33-56.

_____. 1891. Plantas novas cultivadas no Jardim Botanico do Rio de Janeiro 1:10-14.

_____. 1898. Palmae Mattogrossenses Novae vel minus Cognitae, pp. 1-88. Rio de Janeiro.

_____. 1899. Palmae novae Paraguayenses, pp. 7-13. Rio de Janeiro.

_____. 1900. Palmae Hasslerianae novae, pp. 5-13. Rio de Janeiro.

_____. 1901. Palmae Uruguayenses novae vel minus cognitae. Contr. Jard. Bot. Rio de Janeiro 2:23-43.

_____. 1903a. Sertum Palmarum Brasiliensium, ou Relation des Palmiers Nouveaux du Bresil, Decouverts, Descrits et Dessines d'apres Nature 1:1-140, 2:1-114.

_____. 1903b. Palmae *in* R. Chodat & E. Hassler, Plantae Hasslerianae. Bull. Herb. Boissier 2(3):622-626.

_____. 1907. Supplementarum ad Sertum Palmarum Brasiliensium. Contr. Jard. Bot. Rio de Janeiro 4:105-123.

Barry, D. 1957. The African relative of the Chilean wine palm. Principes 1:180-182.

Beccari, O. 1887. Le palme incluse nel genere *Cocos* Linn. Malpighia 1:343-354; 441-454.

_____. 1888. Le palme incluse nel genere *Cocos* Linn. Malpighia 2:85-95; 147-156.

_____. 1910. *Glaziova Treubiana,* nouvelle espece de Cocoineae, avec observations sur le genere *Cocos.* Ann. Jard. Bot. Buitenzorg ser. 2, suppl. 3:791-806.

_____. 1913. Una Nuova Cocoinea Affricana: *Jubaeopsis caffra.* Webbia 4:171-176, figs. 4-5.

_____. 1916. Il genere *Cocos* Linn. e le palme affine. Agric. Colon. 10:435-471; 489-532; 585-623.

_____. 1963. The origin and dispersal of *Cocos nucifera.* Principes 7:57-69. (Reprinted from Philip. Jour. Sci., C. Bot. 12:27-43. 1917).

Bondar, G. 1939. O Coqueiro (*Cocos nucifera* L.) no Brasil. Bol. Inst. Centr. Fomento Econ. Bahia 7:1-100.

_____. 1941. Palmeiras do Genero *Cocos* e descrição de duas especies novas. Bol. Inst. Centr. Fomento Econ. Bahia 9:13-53.

_____. 1942a. New Palms of Bahia. Field Mus. Nat. Hist., Bot. 22:457-463.

_____. 1942b. As ceras no Brasil e o Licuri, *Cocos coronata* Mart. na Bahia. Bol. Inst. Centr. Fomento Econ. Bahia 11:1-86.

_____. 1964. Palmeiras do Brasil, pp. 58-88, figs. 7-30. Instituto de Botanica. São Paulo.

Braun, A. 1968. Cultivated palms of Venezuela. Part II. Principes 12: 135-136, fig. 82.

Burret, M. 1932. Palmae neogeae I. Notizbl. Bot. Gart. Berlin-Dahlem 11:313-327.

_____. 1933. Palmae neogeae III. Repert. Sp. Nov. 32:102-115.

_____. 1937. Die Palmengattung *Syagrus* Mart. Notizbl. Bot. Gart. Berlin-Dahlem 13:677-696.

_____. 1938. Palmae Brasilienses. Notizbl. Bot. Gart. Berlin-Dahlem 14:231-255.

_____. 1940. Palmae neogeae XII. Notizbl. Bot. Gart. Berlin-Dahlem 15:99-108.

Burret, M., and E. Potztal. 1956. Microcoelum, eine neue palmengattung (Cocoideae). Willdenowia 1:386-388.

Chamisso, A. 1822. Choris, Voyage Pittoresque autour du Monde, Traversee de Cronstadt au Chili, 5, pl. 5-6. Paris.

Child, R. 1974. Coconuts. 2nd ed. Longman. London.

Cook, O. F. 1963. History of coconut palm in America. Principes 7:54-57. (Reprinted from Contr. U.S. Natl. Herb. 14:338-342. 1910.)

Costa, J. T. de M. 1967. Primeira Informação sobre as Palmeiras (Palmae) de Pernambuco. Instit. Pesquisas Agronom. Recife (Mimeo). 12 p.

Cuatrecasas, J. 1958. Aspectos de la Vegetacion Natural de Colombia. Revista Acad. Colomb. Ci. Exact. 10:221-268.

Dahlgren, B. E. 1936. Index of American Palms. Field Mus. Nat. Hist., Bot. 14:1-456.

_____. 1959. Index of American Palms. Plates. Field Mus. Nat. Hist., Bot. 14: pls. 1-412.

Dammer, U. 1902. Plantae novae americanae imprimis Glaziovianae. Bot. Jahrb. Syst. 31: 21-23.

Darlington, C. D., and A. P. Wylie. 1945. Chromosome Atlas of Flowering Plants. 2nd ed., pp. 396-397. George Allen and Unwin, Ltd., London.

Davis, R. A., A. P. Anandan, and K. P. V. Menon. 1954. Hermaphroditism in *Cocos nucifera* L. Indian Coconut Jour. 7:133-142.

Dransfield, J., and N. W. Uhl. 1986. An outline of a classification of palms. Principes 30:3-11.

Drude, O. 1881. Martius Flora Brasiliensis 3:253-460.

_____. 1887. Palmae. *In* A. Engler & K. Prantl, Nat. Pflanzenfam. II. 3:81.

Dugand, A. 1955. Palmas Nuevas y Notables de Colombia II. Caldasia 7:129-157.

Eiten, G. 1972. The cerrado vegetation of Brazil. Bot. Rev. 38:201-341.

Gaudichaud, B. C. 1841-52. Voyage autour du monde sur la corvette La Bonite. Bot. Atlas. pl. 51. (*Jubaea spectabilis*). *See* Jour. Arnold Arb. 25:481-487. 1944.

Glassman, S. F. 1963. Nomenclatural changes in the family Palmae. Rhodora 65:259-261.

_____. 1965. Preliminary studies in the palm genus *Syagrus* Mart. and its allies. Fieldiana Bot. 31:147-164.

_____. 1967. New species in the palm genus *Syagrus* Mart. Fieldiana Bot. 31:235-245.

_____. 1968a. New species in the palm genus *Syagrus* Mart. II. Fieldiana Bot. 31:285-299.

_____. 1968b. Studies in the palm genus *Syagrus* Mart. Fieldiana Bot. 31:363-397.

_____. 1968c. *Syagrus oleracea* (Mart.) Becc. and closely related taxa. Fieldiana Bot. 32:13-33.

_____. 1969. Studies in the palm genus *Syagrus* Mart. II. Fieldiana Bot. 32:75-103.

_____. 1970a. A conspectus of the palm genus *Butia* Becc. Fieldiana Bot. 32:127-172.

_____. 1970b. A synopsis of the palm genus *Syagrus* Mart. Fieldiana Bot. 32:215-240.

_____. 1970c. A new hybrid in the palm genus *Syagrus* Mart. Fieldiana Bot. 32:241-257.

_____. 1971a. Rediscovery of *Syagrus werdermannii* Burret. Fieldiana Bot. 34:1-10.

_____. 1971b. Re-evaluation of *Syagrus loefgrenii* Glassman and *S. rachidii* Glassman. Fieldiana Bot. 34:11-25.

_____. 1971c. A new palm hybrid from the Fairchild Tropical Garden. Principes 15:79-88.

_____. 1972a. Systematic studies in the leaf anatomy of palm genus *Syagrus*. Amer. Jour. Bot. 59:775-788.

_____. 1972b. A revision of B.E. Dahlgren's Index of American Palms. J. Cramer. Lehre, Germany. 294 p.

_____. 1977a. Preliminary Taxonomic Studies in the Palm genus *Attalea* H.B.K. Fieldiana Bot. 38:31-61.

_____. 1977b. Preliminary Taxonomic Studies in the Palm genus *Orbignya* Mart. Phytologia 36:89-115.

_____. 1977c. Preliminary Taxonomic Studies in the Palm Genus *Scheelea* Karsten. Phytologia 37:219-250.

_____. 1977d. Notes on *Syagrus microphylla* Burret. Phytologia 38:66-68.

_____. 1978a. Preliminary Taxonomic Studies in the Palm Genus *Maximiliana* Mart. Phytologia 38:161-172.

_____. 1978b. New species of *Syagrus* from the state of Bahia (Brazil), with a revisional study of closely related taxa. Phytologia 39:401-423, figs. 1-17.

_____. 1978c. Corrections and changes in recent palm articles published in Phytologia. Phytologia 40:313-315.

_____. 1979. Re-evaluation of the genus *Butia* with a description of a new species. Principes 23:65-79, figs. 1-10.

Glassman, S. F., J. B. Harborne, J. Robertson, and P. Holloway. 1981. Chemotaxonomic studies of selected Cocosoid Palms. Principes 25:54-62.

Gopaul Rao, T. 1948. A note on the occurrence of a hermaphrodite flower in coconut (*Cocos nucifera* L.). Jour. Indian Bot. Soc. 27:208-211.

Harley, R. M., and S. J. Mayo. 1980. Towards a checklist of the flora of Bahia, p. 159. Royal Botanic Gardens, Kew.

Harries, H. C. 1978. Evolution, dissemination and classification of *Cocos nucifera* L. Bot. Rev. 44:265-319.

Hodge, W. H. 1957. *Rhyticocos amara.* Principes 1:176-179, 3 figs.

Holmgren, P. K., W. Keuken, and E. K. Schofield. 1981. Index Herbariorum. Part I. The herbaria of the world. 7th ed. Utrecht. 452 p.

Humboldt, A., A. Bonpland, and C. S. Kunth. 1816. Nov. Gen. Sp. Pl. 1:198-318.

John, C. M., and G. V. Narayana. 1942. The male coconut tree. Madras Agric. Jour. 31:75-77.

Karsten, H. 1857. Plantae Columbianae. Linnaea 28:241-281.

_____. 1866. Florae Columbianae 2:147, t. 177.

Kerchove de Denterghem, O. 1878. Les Palmiers. Paris. 348 p.

Kitzke, E. D., and D. Johnson. 1975. Commercial palm products other than oils. Principes 19:3-26.

Ledin, R. B. 1958. The Arikury palm. Principes 2:59-63, figs. 42-44.

Martius, C. F. P. von. 1818. Langsdorffia-Balanophoraceae. Eschweg. Jour. Bras. 2:178.

_____. 1824. Palmarum familia ejusque genera denuo illustrata. 3-24. Munich.

_____. 1826. Hist. Nat. Palm. 2:91-144. t. 68-101.

_____. 1844. Palmetum Orbignianum *in* A. d'Orbigny, Voyage dans l'Amerique meridionale 7(3):1-140. Paris.

_____. 1845. Hist. Nat. Palm. 3:261-304, t. R-Z(7), 165-170.

_____. 1853. Hist. Nat. Palm. 3:315-350.

Michalowski, M. 1958. The ecology of Paraguayan palms. Principes 2:52-58.

Moore, H. E., Jr. 1962. Allagoptera and Diplothemium. Principes 6:37-39.

_____. 1963a. Two new palms from Peru. Principes 7:107-115.

_____. 1963b. The types and lectotypes of some palm genera. Gentes Herb. 9:245-274.

_____. 1973. The major groups of palms and their distribution. Gentes Herb. 11(2):27-141.

_____. 1977. Endangerment at the specific and generic levels in palms. Pp. 267-282, fig. 1 *in* G.T. Prance and T.S. Elias, eds., Extinction is forever. Cary Arboretum of New York Botanical Garden, Millbrook.

_____. 1982. An overlooked name for a hybrid between *Arecastrum* and *Butia*. Principes 26:50.

Moore, H. E., Jr., and J. Dransfield. 1979. The typification of Linnaean palms. Taxon 28:59-70, fig. 5.

Moore, H. E., Jr., and F. R. Fosberg. 1956. The palms of Micronesia and the Bonin Islands. Gentes Herb. 8(6):471-475, fig. 138.

Polysciences. 1981. JB-4 Plastic embedding media. Data sheet No. 123. Paul Valley Industrial Park, Warrington, Pennsylvania.

Raddi, G. 1820. Mem. Mat. Fis. Soc. Ital. Sci. Modena, Pt. Mem. Fis. 18:345, 347.

Read, R. W. 1966. New chromosome counts in the Palmae. Principes 10:55-61.

_____. 1979. Palms of the Lesser Antilles. Pp. 349-352, fig. 72 *in* R. A. Howard, Flora of the Lesser Antilles. Leeward and Windward Islands. 3: Monocotyledonae. Jamaica Plain, Mass.

Reiche, K. 1907. Die Vegetation der Erde 8:66.

Rheede tot Drankenstein, H. A. van. 1678-1703. *Hortus Indicus Malabaricus.* 12 vols. Amsterdam.

Robertson, B. L. 1977a. Morphology and development of the fruit and seed of *Jubaeopsis caffra* Becc. Principes 21:23-30, figs. 1-6.

_____. 1977b. Aspects of the morphology of *Jubaeopsis caffra* Becc. Principes 21:169-175, figs. 1-10.

Saakov, S. G. 1963. Introduction of palms in the U.S.S.R. Principes 7:88-99.

Sowunmi, M. A. 1972. Pollen morphology of the Palmae and its bearing on taxonomy. Rev. Palaeobot. Palyn. 13:1-80.

Stevenson, G. 1974. Palms of South Florida. Miami. Privately published. 251 p.

Thanikaimoni, G. 1971. Les Palmiers: Palynologie et Systematique.

Inst. Francais Pondichery. Travaux Section Scientifique et Technique. Tome XI:1-286. schema 1-11, pls. 1-22.

Toledo, J. F. 1944. Estudos sobre algumas Palmeiras do Brasil. I. Um novo genero da Tribu Cocoeae. Arq. Bot. S. Paulo 2:3-9.

Tomlinson, P. B. 1961. Anatomy of the Monocotyledons. II. Palmae, figs. 1-45, pls. 1-9. Oxford. 453 p.

Uhl, N., and H. E. Moore, Jr. 1973. The protection of pollen and ovules in palms. Principes 17:111-149, fig. 25.

Wendland, H. 1854. Index Palmarum. pp. 1-48, 57-67. Hannover.

_____. 1871. *In* T. Moore, Pictures of palm trees. II. *Cocos weddelliana.* Florist and Pomologist 1871:114. London.

_____. 1878. *In* Kerchove de Denterghem, Les Palmiers. Paris. 348 p.

Wessels Boer, J. G. 1965. The indigenous palms of Suriname, pp. 170-172. Leiden.

Wicht, H. 1969. Indigenous palms of Southern Africa, pp. 34-37. Howard Timmins. Capetown.

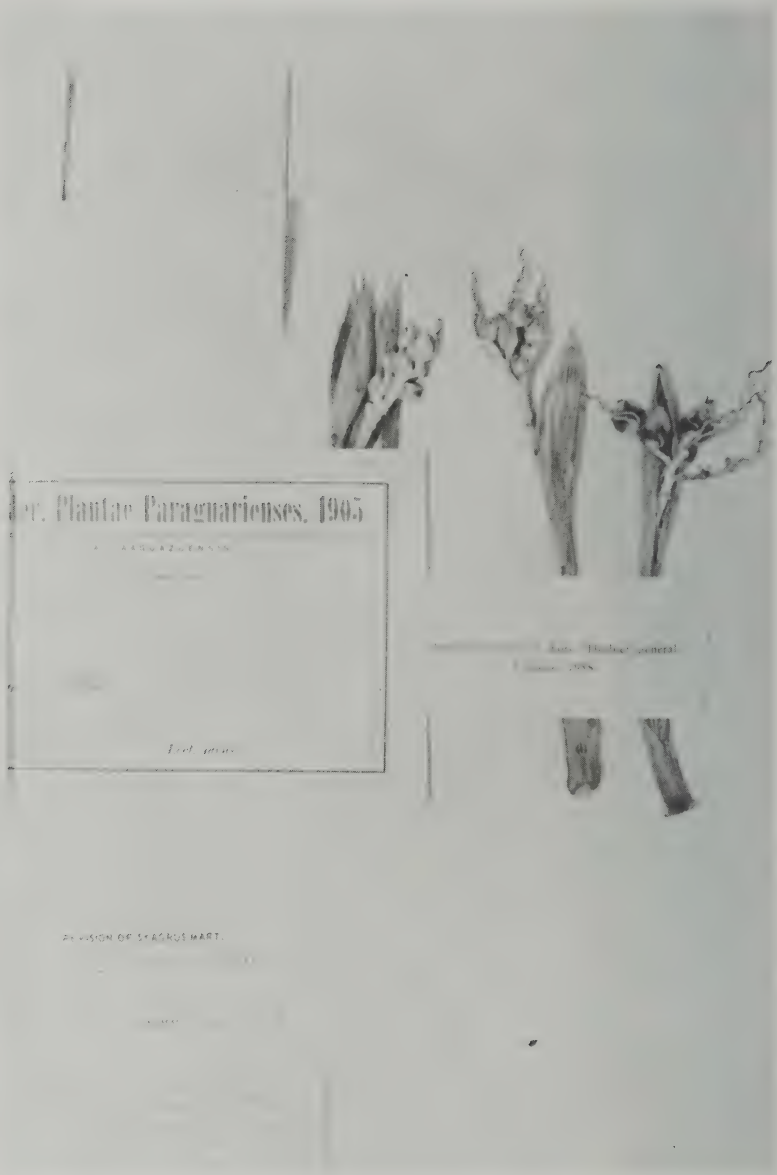
Williams, C. A., J. B. Harborne, and H. T. Clifford. 1973. Negatively charged flavones and tricin as chemosystematic markers in the Palmae. Phytochem. 12:2417-2430.

Williams, C. A., J. B. Harborne, and S. F. Glassman. 1983. Flavonoids as taxonomic markers in some cocosoid palms. Pl. Syst. Evol. 142:157-169.

Figures

1. *S. botryophora.* Flowers, fruits, and leaf. *Bondar s.n.* (F-619734).

2. *S. cocoides.* Photo by George Hübner. Manaus. 1935.



3. *S. lilliputiana. Hassler 9519* (G). Showing small inflorescences.

4. *S. lilliputiana. Hassler 9519* (G). Showing whole plant with subterranean stem.

UB HERBÁRIO
UNIVERSIDADE
DE BRASÍLIA
REVISION OF SYAGRUS MART.
Anderson 10247
Syagrus petraea (Drude) Becc.
PLANTS OF THE PLANALTO DO BRASIL
Collected for The New York Botanical Garden by W. R. Anderson,
Estado de Goiás
Serra dos Pirineus
Ca. 15 km (straight line) N of Corumbá de
Goiás: elev. 1250-1300 m; wooded hill of
quartzite outcrops and sandy, rocky
its base.
May 1973

5. *S. petraea. Anderson 10247* (UB). Environmental variation. Compare with *Heringer 8926* (UB).

6. *S. petraea. Heringer 8926* (UB). Environmental variation. Compare with *Anderson 10247* (UB).

7. *S. botryophora.* Bahia, 8 km W of Lage. Mr. Costa, Mr. Edgar, and Mr. Moises holding heavy infructescences and whole leaf.

8. *S. glaucescens.* Tree in cerrado showing fruiting bracts. Minas Gerais, Serra de Biribiry.

9. *S. harleyi.* Bahia, 3 km N of Mucugé, near type locality. Trunkless

10. *S. microphylla.* Bahia, Morro de Chapeu, near type locality. Trunkless plants growing on white sandy soil. Photo by Simon Mayo, 1977.

11. *S.* × *matafome.* One of two trees observed in 1969. Bahia, 14 km W of Teresinha. Parent species, *S. cerqueira* and *S. vagans* in background.

12. *S. flexuosa.* São Paulo, secondary growth area between Araraquara and Baurú.

13. *Microcoelum weddellianum. Lhotsky s.n.* (G). One of the earliest collections of this species in 1832 and probably collected at the same time as lectotype. Note dark pubescence of bracts and leaf sheaths.

14. *Jubaeopsis caffra. Ross s.n.* (K). Lectotype.

15. *Microcoelum insigne. Glaziou 2757* (FI). Paratype (not holotype). Note blackish pubescence on bract.

16. *Microcoelum insigne. Glaziou 2757* (FI). Paratype. Note blackish pubescence on petiole and leaf rachis.

17. *Barbosa pseudococos.* From Raddi (1820) t.1. Lectotype.

18. *Rhyticocos amara. Broadway s.n.* (F). Fruit and seed showing ruminate endosperm.

19. *Jubaea chilensis.* Chile, Cocolan. Photo by Victor Bianchi (A).

20. *Jubaeopsis caffra.* From Wicht (1969) p. 34. Along bank of river in Pondoland, South Africa.

Flower Plates

Plate I.

1. *S. acaulis.* Pistillate flowers. External view and longitudinal section (X4 and X5) *Gardner 3495* (M).
2. *S. botryophora.* Pistillate (X4 and X5) and staminate (X3) flowers. External view and longitudinal section. *Bondar s.n.* (F-619734).
3. *S. campicola.* Pistillate (X4) and staminate (X3) flowers. External view and longitudinal section. *Hassler 6871* (G).
4. *S. campylospatha.* Pistillate (X4) and staminate (X3) flowers. External view and longitudinal sections. *Hassler 2163* (G). Note nerved sepals.
5. *S. cardenasii.* Pistillate (X3) and staminate (X3) flowers. External view and longitudinal sections. *M. Cardenas 5500* (BH). Note pubescent ovary.
6. *S. cocoides.* Pistillate (X3) and staminate (X2) flowers. External view and longitudinal section. *J. Huber 9357* (FI). Note pubescent ovary.
7. *S. comosa.* Pistillate (X4) and staminate (X3) flowers. External view and longitudinal section. *Glaziou 22263* (K). Note thick staminate petals.

PLATE I

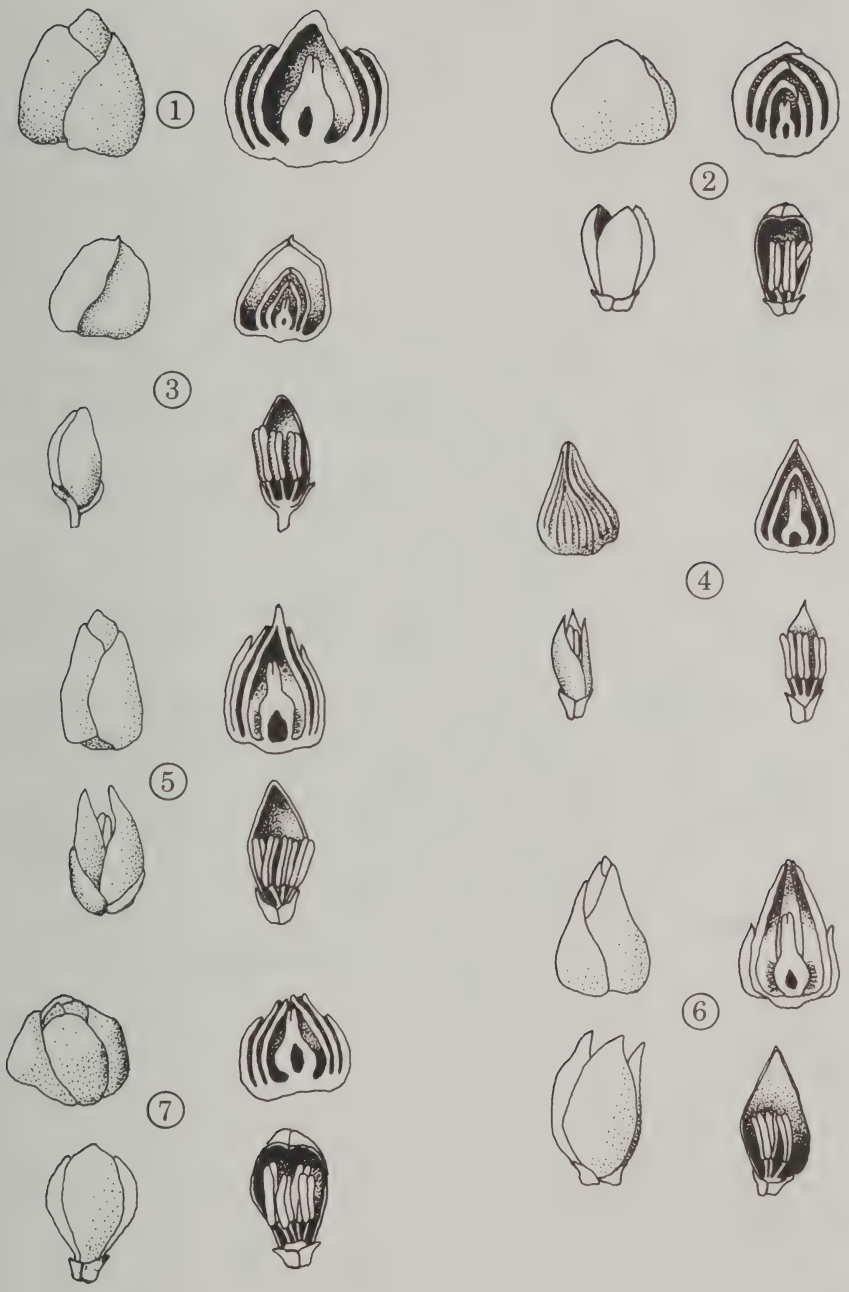


Plate II.

1. *S. coronata.* Pistillate (X4) and staminate (X4) flowers. External view and longitudinal sections and cross section of pistillate flower (X3). *Glassman & Costa 8723* (CHI).
2. *S. duartei.* Pistillate (X2) and staminate (X2.5) flowers. External view and longitudinal section. *Glassman & Gomes 8033* (CHI).
3. *S. flexuosa.* Pistillate (X2) and staminate (X3) flowers. External view and longitudinal section and cross section of pistillate flower (X3). *Glassman & Gomes 8002* (CHI).
4. *S. glaucescens.* Pistillate (X2) and staminate (X2) flowers. External view and longitudinal section and cross section of pistillate flower (X4). *Glassman & Gomes 8111* (CHI).
5. *S. graminifolia.* Pistillate (X3) and staminate (X2) flowers. External view and longitudinal section. *Glaziou 22252* (G) and *Weddell 2795* (P).
6. *S. inajai.* Pistillate (X5) and staminate (X3) flowers. External view and longitudinal section. *J. Huber 2731* (MG) and *J. Huber 993* (MG).

PLATE II

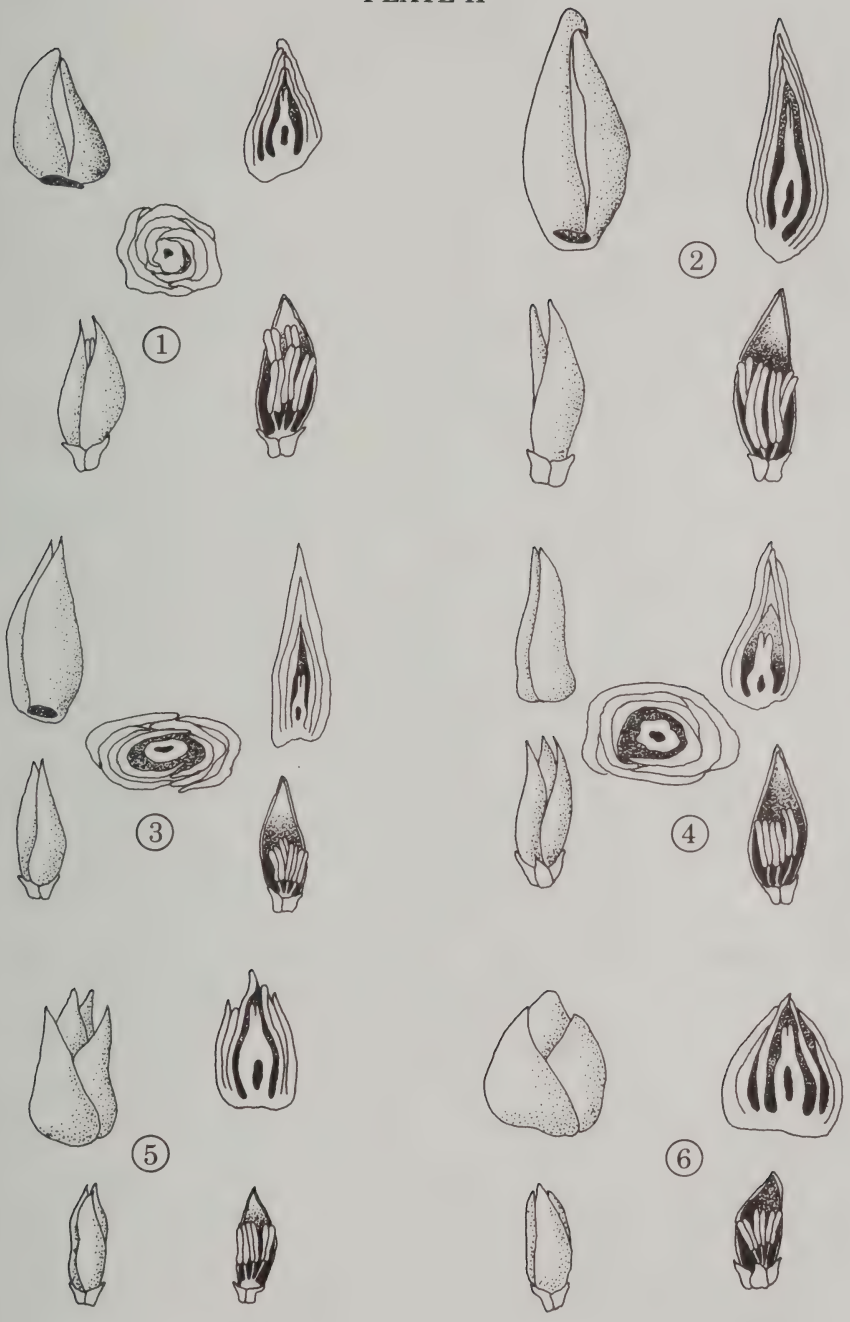


Plate III.

1. *S. leptospatha.* Pistillate (X3 and X4) and staminate (X5) flowers. External view and longitudinal section. *Archer & Gehrt 3915* (SP).
2. *S. lilliputiana.* Pistillate (X3) flower. External view and longitudinal section. *Hassler 9519* (G). Note nerved sepals and pubescent ovary.
3. *S. loefgrenii.* Pistillate (X2) and staminate (X3) flowers. External view and longitudinal section. *Glassman 8748* (CHI).
4. *S. microphylla.* Pistillate (X3) and staminate (X3) flowers. External view and longitudinal section. *Glassman 13030* (CHI). Note nerved sepals.
5. *S. macrocarpa.* Pistillate (X1) and staminate (X3) flowers. External view and longitudinal section. *Glaziou 9015* (C). Note pubescent ovary.
6. *S. oleracea.* Pistillate (X2) and staminate (X2) flowers. External view and longitudinal section and cross section of pistillate (X3) flower. *Glassman & Costa 8706* (CHI) and *Glassman & Gomes 8005* (CHI). Note wrinkled pistillate sepals.
7. *S. orinocensis.* Pistillate (X3) and staminate (X3) flowers. External view and longitudinal section. *Pittier 9154* (NY). Note pubescent ovary and nerved petals of staminate flower.

PLATE III

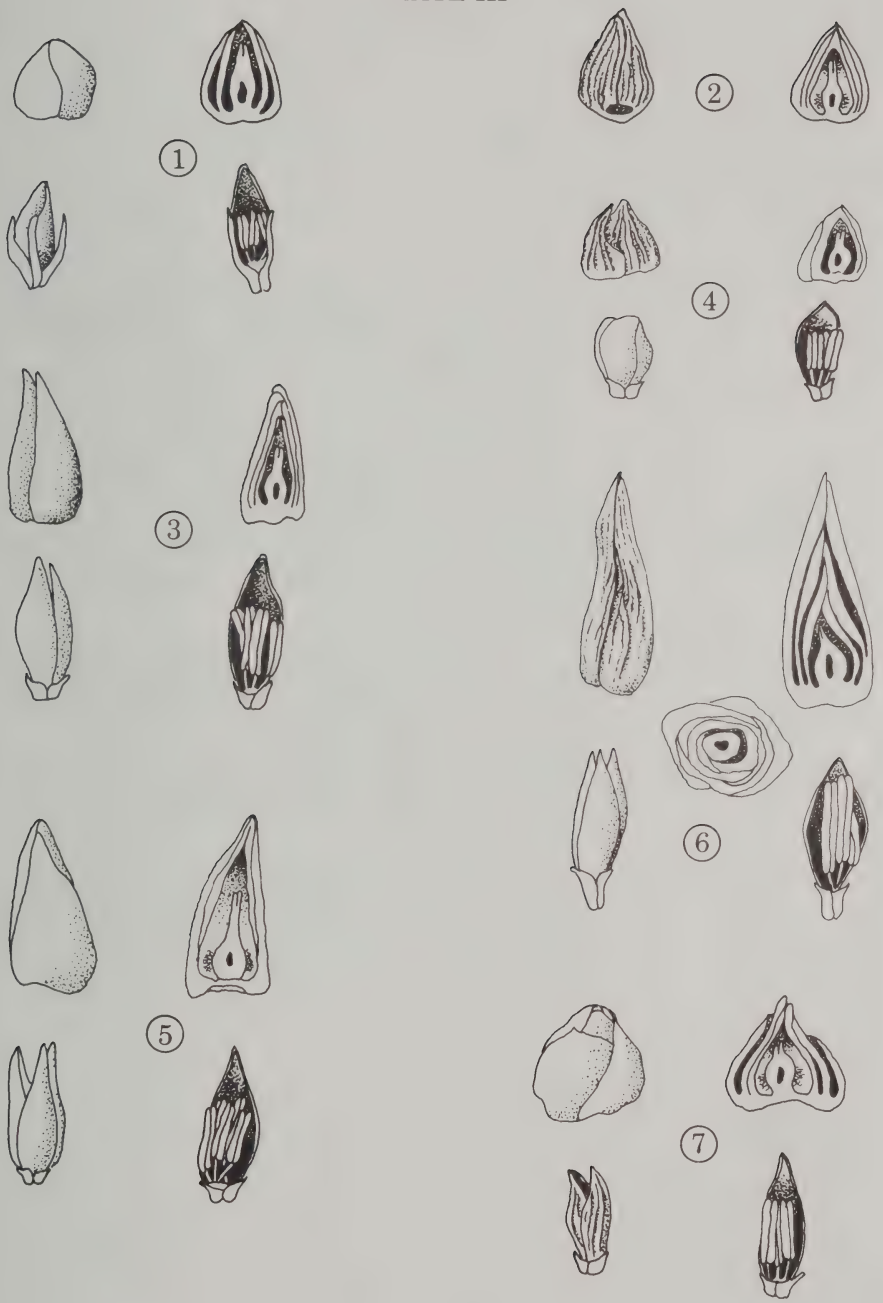


Plate IV.

1. *S. petraea.* Pistillate (X2 and X3) and staminate (X2 and X2.5) flowers. External view and longitudinal section. *Glaziou 22255* (G) and *22257* (G).
2. *S. pleioclada.* Pistillate (X2 and X3) and staminate (X3) flowers. External view and longitudinal section and cross section of pistillate flower (X3). *Glassman & Gomes 8041* (CHI). Note thick petals in both pistillate and staminate flowers.
3. *S. ruschiana.* Pistillate (X5) and staminate flowers (X4). External view and longitudinal section. *Glassman & Costa 8743* (CHI).
4. *S. sancona.* Pistillate (X5) and staminate (X4) flowers. External view and longitudinal section. *Wessels Boer 1766* (F). Note wrinkled perianth of pistillate flower and obtuse apices.
5. *S. stratincola.* Pistillate (X2) and staminate (X2) flowers. External view and longitudinal section. *Wessels Boer 1303* (F).
6. *S. vagans.* Pistillate (X4) and staminate (X4) flowers. External view and longitudinal section. *Glassman & Costa 8725* (CHI). Note nerved pistillate sepals on apical half.

PLATE IV

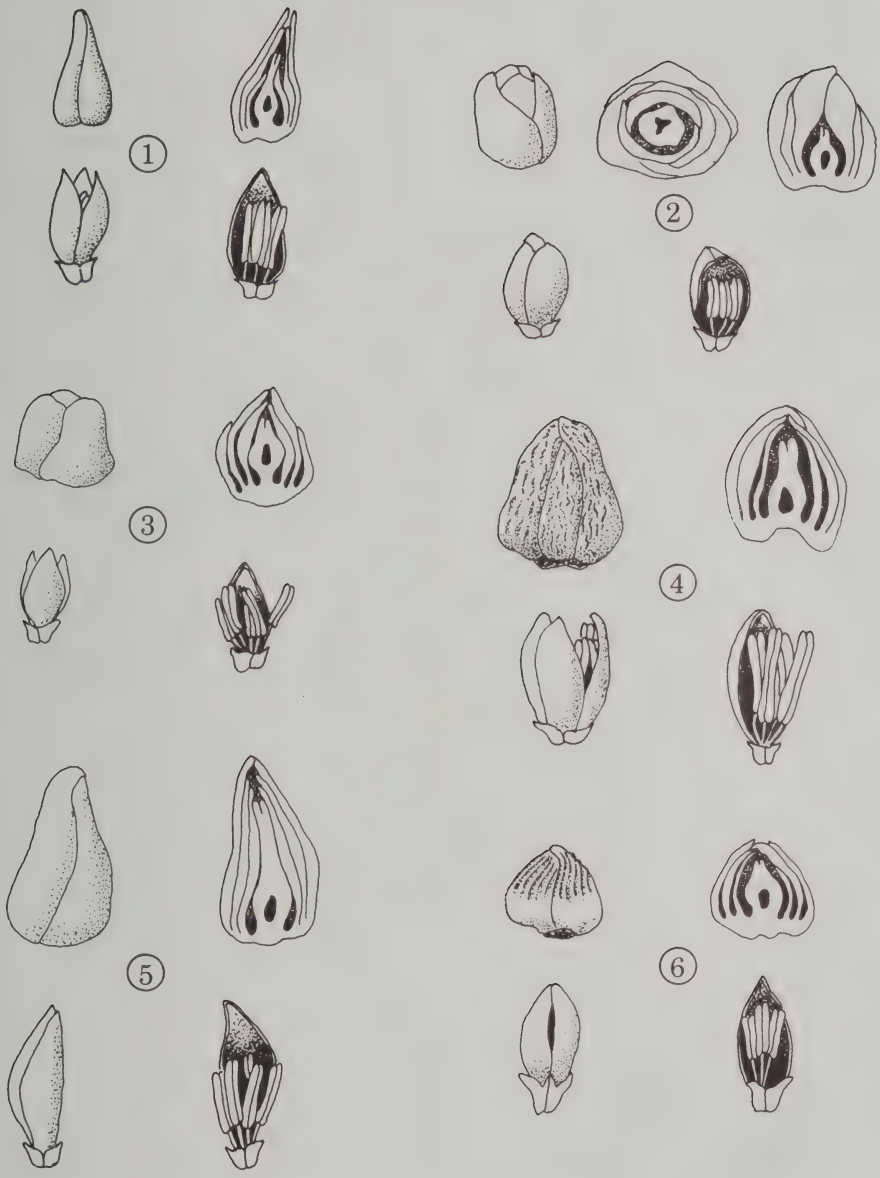


Plate V.

1. *S. werdermannii.* Pistillate (X5) and staminate (X4) flowers. External view and longitudinal section. *Glassman & Costa 8728* (CHI). Note nerved pistillate sepals.
2. *S.* × *camposportoana.* Pistillate (X5) and staminate (X3) flowers. External view and longitudinal section. *Bondar s.n.* (F-619766).
3. *S.* × *costae.* Pistillate (X2 and X3) and staminate (X2) flowers. External view and longitudinal section. *Glassman & Costa 8707* (CHI). Note wrinkled pistillate sepals.
4. *S.* × *tostana.* Pistillate (X3) and staminate (X3) flowers. External view and longitudinal section. *Bondar s.n.* (F-619735). Note partially nerved pistillate sepals.
5. *S.* × *matafome.* Pistillate (X5) and staminate (X5) flowers. External view and longitudinal section. *Bondar s.n.* (F-619770).
6. *S.* × *teixeiriana.* Pistillate (X3 and X4) and staminate (X4 and X5) flowers. External view and longitudinal section. *Glassman & Gomes 8007* (CHI).

PLATE V

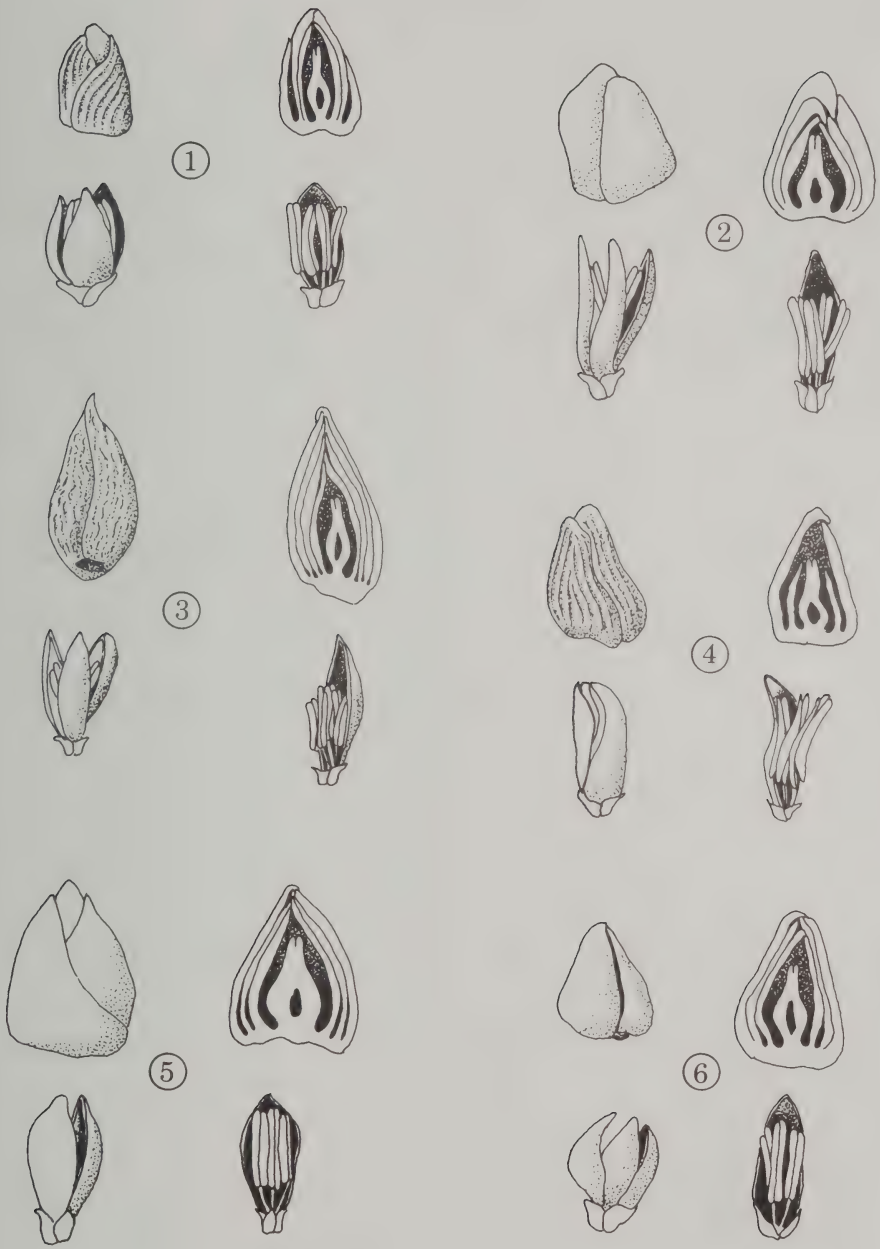


Plate VI.

1. × *Butiarecastrum nabonnandii.* Pistillate (X3) and staminate (X3) flowers. External view and longitudinal section. *Glassman 8765* (CHI). Note nerved pistillate sepals.
2. *Arecastrum romanzoffianum.* Pistillate (X4 and X5) and staminate (X2 and X3) flowers. External view and longitudinal section. *Glassman & Costa 8742* (CHI). Note pubescent ovary.
3. *Arikuryroba schizophylla.* Pistillate (X4) and staminate (X5) flowers. External view and longitudinal section. *Glassman & Costa 8708* (CHI).
4. *Barbosa pseudococos.* Pistillate (X1) and staminate (X2) flowers. External view and longitudinal section. *Bondar s.n.* (F-620751). Note obtuse apices of pistillate flower.
5. *Lytocaryum hoehnei.* Pistillate (X5 and X4) and staminate (X3) flowers. External view and longitudinal section. *Gehrt s.n.* (SP-43163). Note nerves on apical half of pistillate sepals.
6. *Microcoelum weddellianum.* Pistillate (X7) and staminate (X10) flowers. External view and longitudinal section. *Herb. Saldanha s.n.* (R-44704). Note nerved pistillate sepals.

PLATE VI

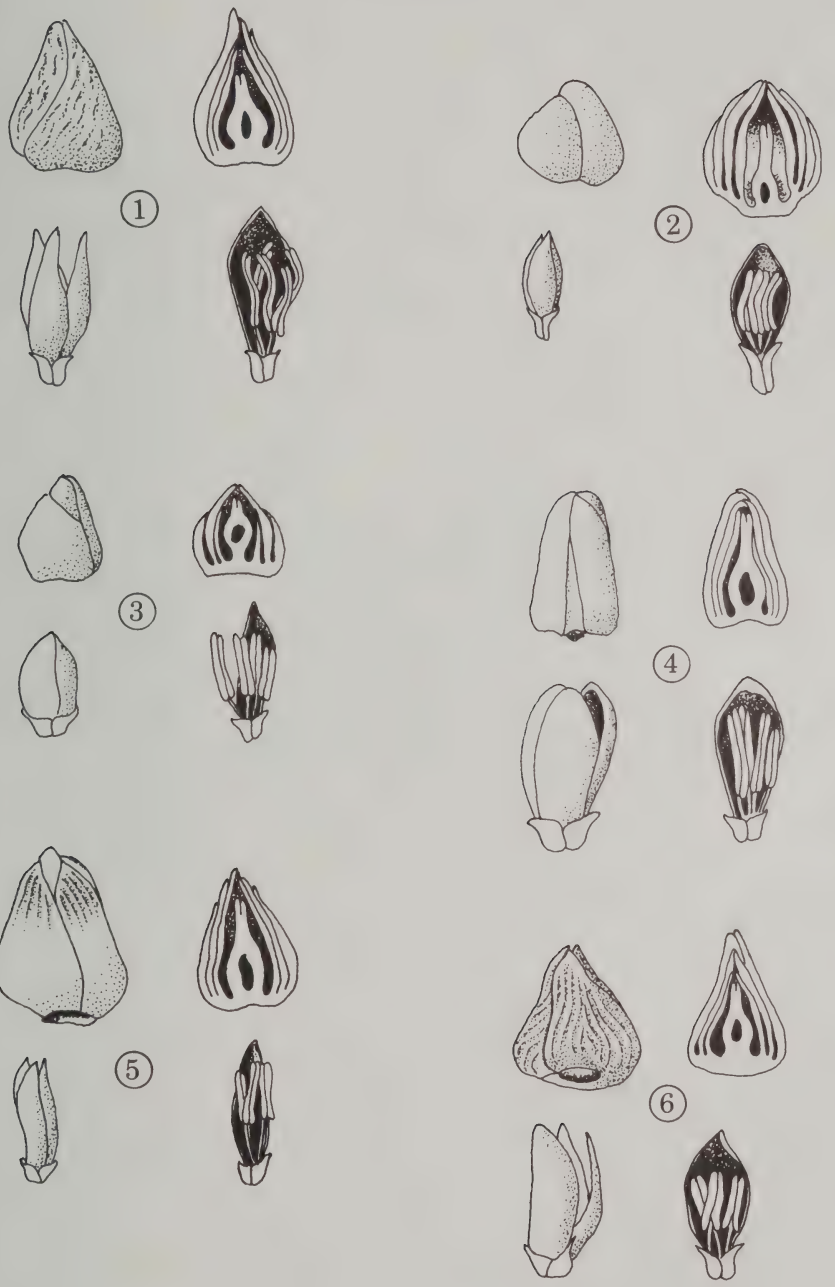
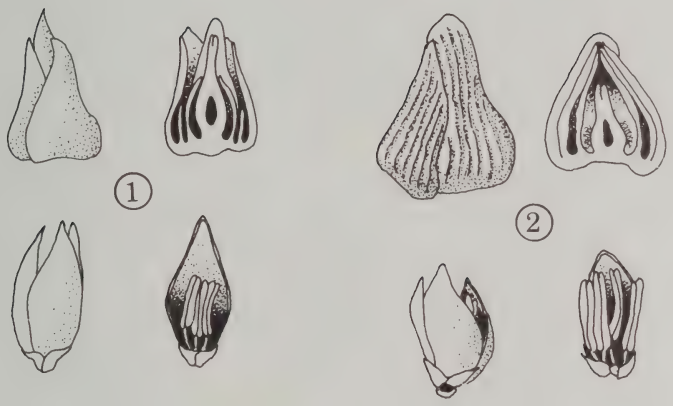


Plate VII.

1. *Microcoelum insigne.* Pistillate (X6) and staminate (X5) flowers. External view and longitudinal section. *H. Luederwaldt s.n.* (SP-24150) and *Glaziou 2757* (F).
2. *Rhyticocos amara.* Pistillate (X3) and staminate (X3) flowers. External view and longitudinal section. *Lloyd 675* (NY). Note nerved pistillate sepals and pubescent ovary.

PLATE VII



Leaf Anatomy Plates

Cross sections of laminae and midribs. On line drawings, double lines on upper (adaxial) and lower (abaxial) sides represent upper and lower epidermis. Solid tissues indicate clusters of nonvascular fibers, and circles depict veins of various sizes. All other tissues have been omitted from diagrams. Midrib sections show main vascular bundle, other bundles, and expansion cell tissue, which is either single or divided. Magnification and voucher specimens follow species name.

Plate I.

Fig. 1. *Syagrus campicola.* Lamina, X55. *Hassler 5057* (G).
Fig. 2. *S. leptospatha.* Lamina, X42. *Archer & Gehrt 3915* (SP-36429).
Fig. 3. *S. campylospatha.* Lamina, X55. *Hassler 7164* (G).
Fig. 4. *S. campylospatha.* Midrib, X55. *Hassler 7164* (G).
Fig. 5. *S. graminifolia.* Lamina, X55. *Swallen 9520* (US).
Fig. 6. *S. lilliputiana.* Lamina, X42. *Hassler 9519* (G).

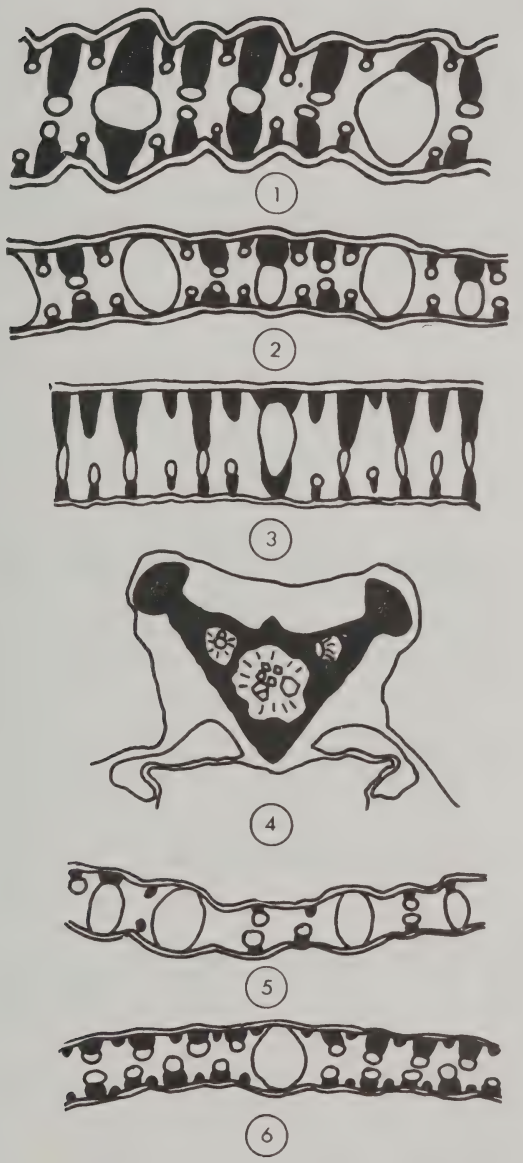

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Plate II.

Fig. 1. *Arikuryroba schizophylla.* Lamina, X55. *Glassman & Costa 8721* (CHI).
Fig. 2. *Syagrus ruschiana.* Lamina, X55. *Glassman & Costa 8743* (CHI).
Fig. 3. *S. vagans.* Lamina, X33. *Glassman & Costa 8725* (CHI).
Fig. 4. *S. werdermannii.* Lamina, X55. *Glassman & Costa 8728* (CHI).
Fig. 5. *S. microphylla.* Lamina, X55. *Glassman 13018* (CHI).
Fig. 6. *S. harleyi.* Lamina, X55. *Harley et al. 15963* (F).

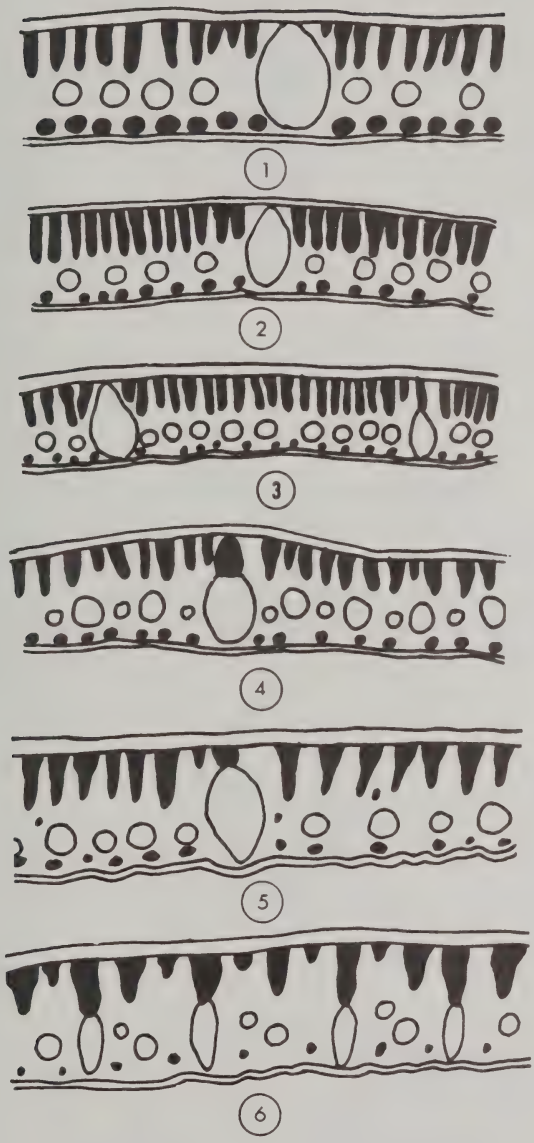
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Plate III.

Fig. 1. *Syagrus pleioclada.* Midrib, X33. *Glassman & Gomes 8039* (CHI).
Fig. 2. *S. pleioclada.* Lamina, X55. *Glassman & Gomes 8039* (CHI).
Fig. 3. *S. mendanhensis.* Midrib, X55. *W. A. Archer 4086* (US).
Fig. 4. *S. mendanhensis.* Lamina, X55. *W. A. Archer 4086* (US).

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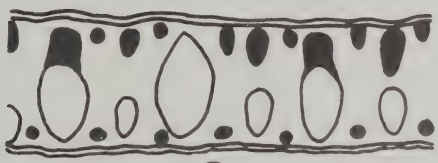

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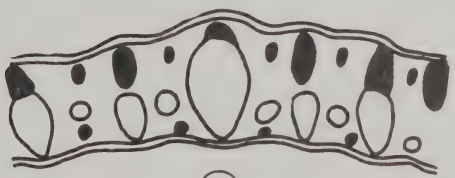

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Plate IV.

Fig. 1. *Syagrus loefgrenii.* Midrib, X55. *Glassman & Gomes 8015* (CHI).
Fig. 2. *S. loefgrenii.* Lamina, X55. *Glassman & Gomes 8015* (CHI).
Fig. 3. *S. cardenasii.* Midrib, X55. *M. Cardenas 5500* (BH).
Fig. 4. *S. cardenasii.* Lamina, X55. *M. Cardenas 5500* (BH).
Fig. 5. *S. macrocarpa.* Midrib, X55. *Glaziou 9015* (FI).
Fig. 6. *S. macrocarpa.* Lamina, X42. *Glaziou 9015* (FI).

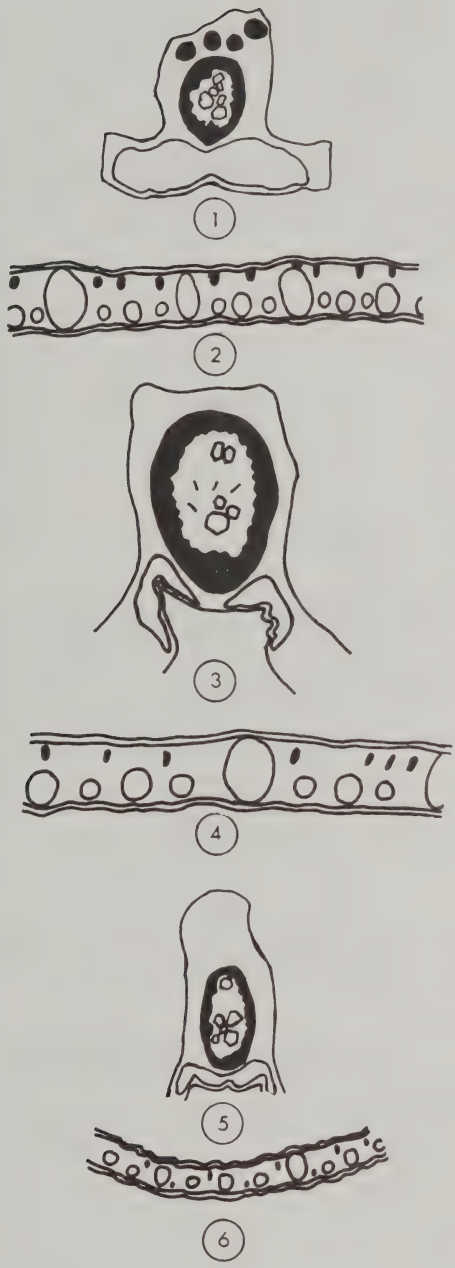
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Plate V.

Fig. 1. *Arecastrum romanzoffianum.* Lamina, X55. *Glassman & Costa 8742* (CHI).
Fig. 2. *Syagrus comosa.* Lamina, X33. *E. Y. Dawson 15521* (BH).
Fig. 3. *S. duartei.* Midrib, X33. *Glassman & Gomes 8033* (CHI).
Fig. 4. *S. duartei.* Lamina, X33. *Glassman & Gomes 8033* (CHI).
Fig. 5. *S. glaucescens.* Midrib, X55. *Archer & Gehrt 4078* (US).
Fig. 6. *S. glaucescens.* Lamina, X33. *Archer & Gehrt 4078* (US).

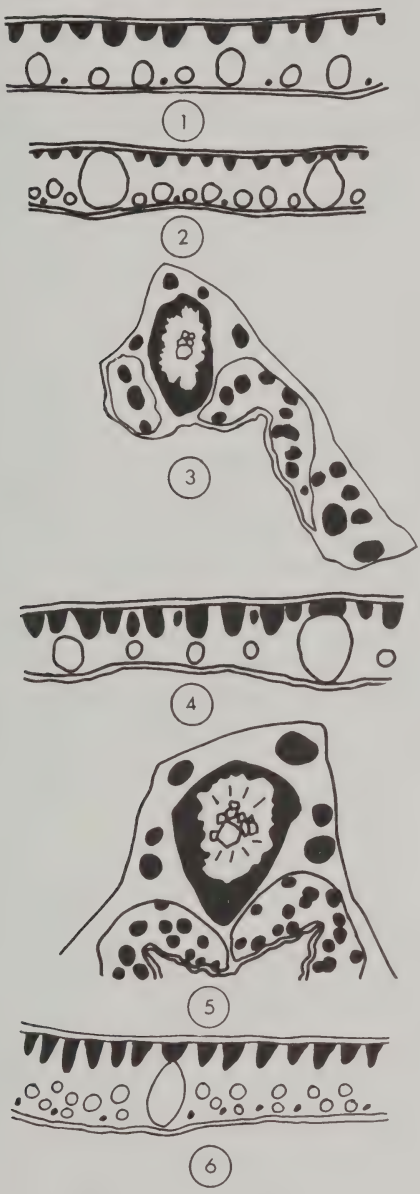
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Plate VI.

Fig. 1. *Chrysallidosperma smithii.* Midrib, X33. *Moore et al. 8375* (BH).
Fig. 2. *C. smithii.* Lamina, X55. *Moore et al. 8375* (BH).
Fig. 3. *Syagrus inajai.* Midrib, X33. *Dahlgren s.n.* (F-620810).
Fig. 4. *S. inajai.* Lamina, X33. *Dahlgren s.n.* (F-620810).
Fig. 5. *S. orinocensis.* Midrib, X33. *Allen 3352* (MO).
Fig. 6. *S. orinocensis.* Lamina, X42. *Allen 3352* (MO).
Fig. 7. *S. stratincola.* Midrib, X42. *Wessels Boer 1303* (F).
Fig. 8. *S. stratincola.* Lamina, X42. *Wessels Boer 1303* (F).

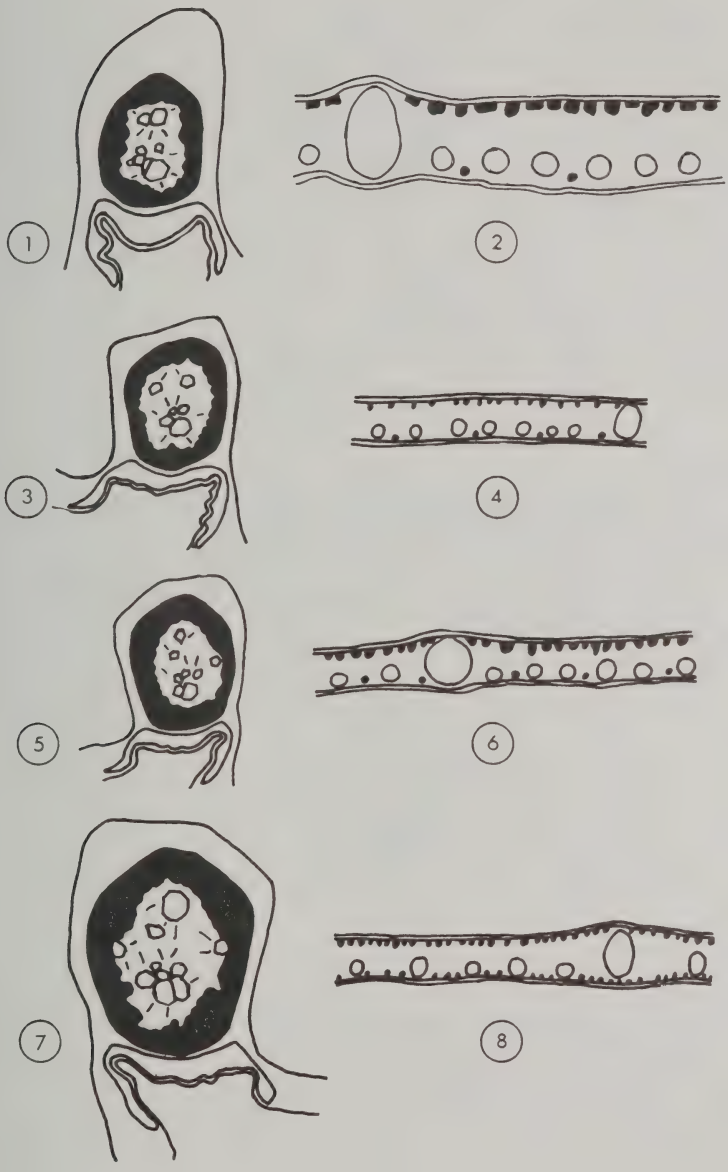
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Plate VII.

Fig. 1. *Syagrus acaulis.* Midrib, X55. *Gardner 3495* (M).
Fig. 2. *S. acaulis.* Lamina, X55. *Gardner 3495* (M).
Fig. 3. *S. coronata.* Lamina, X42. *Glassman & Costa 8702* (CHI).
Fig. 4. *S. petraea.* Midrib, X55. *Glaziou 22254* (C).
Fig. 5. *S. petraea.* Lamina, X55. *Glaziou 22254* (C).

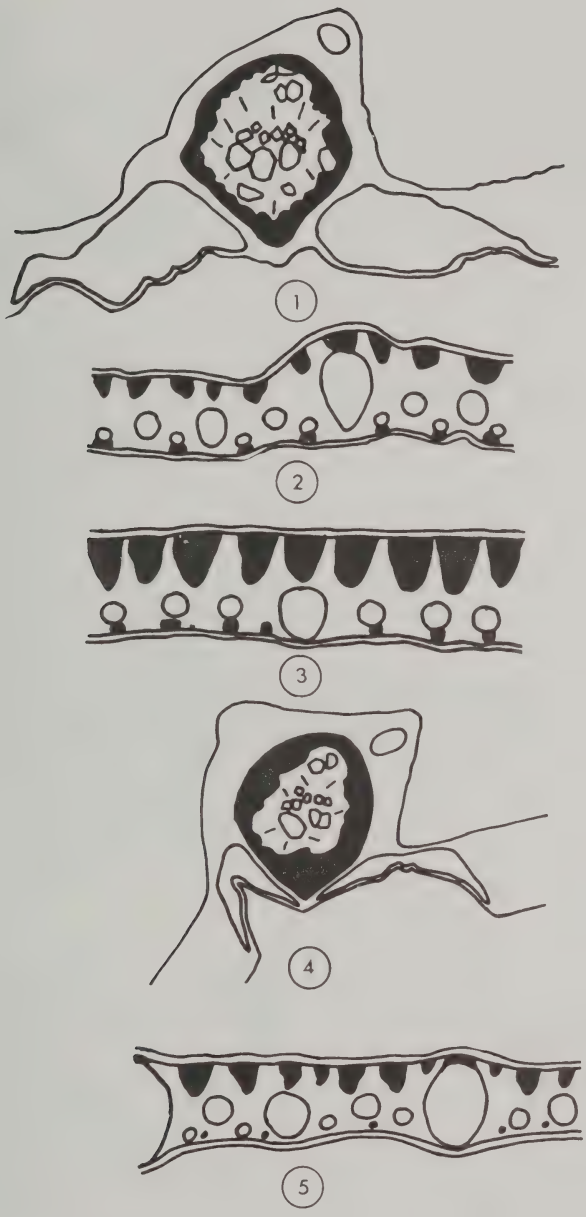
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Plate VIII.

Fig. 1. *Syagrus oleracea.* Midrib, X55. *Glassman & Gomes 8003* (CHI).
Fig. 2. *S. oleracea.* Lamina, X55. *Glassman & Costa 8706* (CHI).
Fig. 3. *S. flexuosa.* Midrib, X55. *Glassman & Gomes 8046* (CHI).
Fig. 4. *S. flexuosa.* Lamina, X55. *Glassman & Gomes 8046* (CHI).
Fig. 5. *S. sancona.* Midrib, X33. *Wessels Boer 1766* (CHI).
Fig. 6. *S. sancona.* Lamina, X33. *Wessels Boer 1766* (CHI).
Fig. 7. *Barbosa pseudococos.* Midrib, X55. *Bondar s.n.* (F-404607).
Fig. 8. *B. pseudococos.* Lamina, X33. *Bondar s.n.* (F-404607).

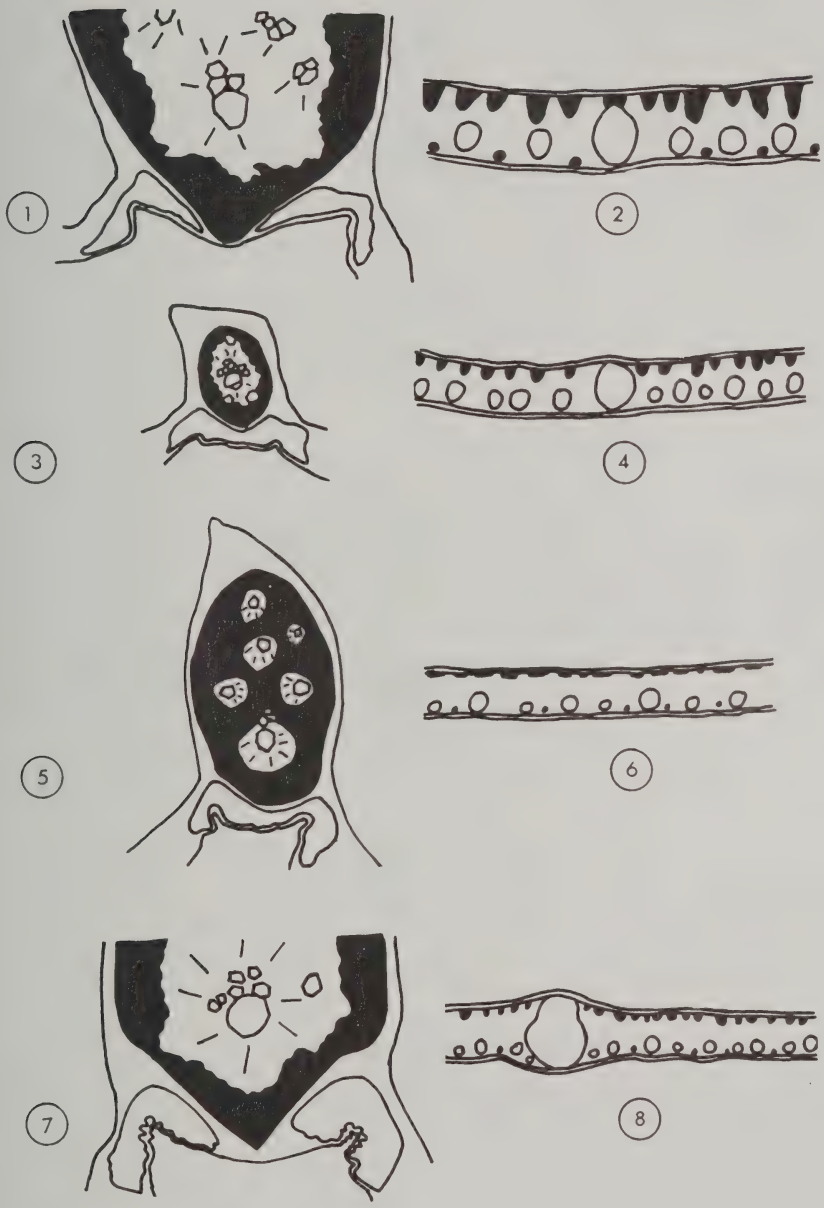
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Plate IX.

Fig. 1. *Microcoelum insigne.* Midrib, X55. *Glaziou 2727* (FI).
Fig. 2. *M. insigne.* Lamina, X55. *Glaziou 2727* (FI).
Fig. 3. *M. weddellianum.* Midrib, X55. *Lhotsky s.n.* (G).
Fig. 4. *M. weddellianum.* Lamina, X55. *Lhotsky s.n.* (G).
Fig. 5. *Lytocaryum hoehnei.* Midrib, X55. *Gehrt s.n.* (SP-23518).
Fig. 6. *L. hoehnei.* Lamina, X55. *Gehrt s.n.* (SP-23518).

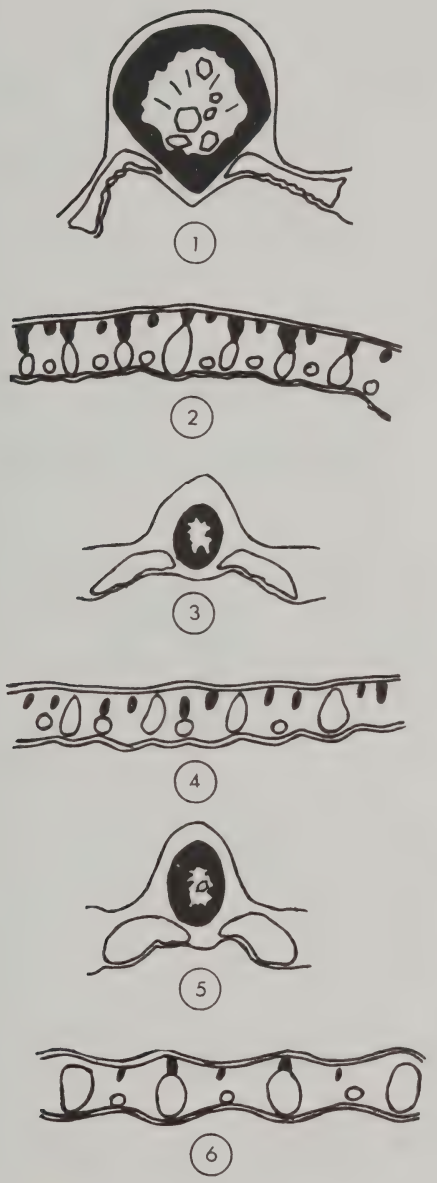
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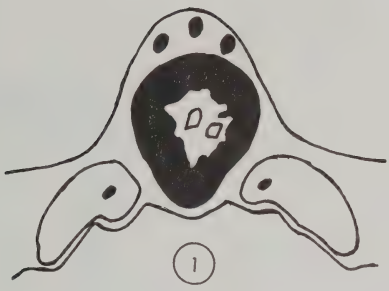
Plate X.

Fig. 1. *Jubaea chilensis.* Midrib, X55. *Moore 9366* (GH).
Fig. 2. *J. chilensis.* Lamina, X55. *Moore 9366* (GH).
Fig. 3. *Jubaeopsis caffra.* Midrib, X55. *J. Burtt Davy 15302* (K).
Fig. 4. *J. caffra.* Lamina, X55. *Ross s.n.* (K).
Fig. 5. *J. caffra.* Lamina, X55. *Kiem 10421* (CHI).



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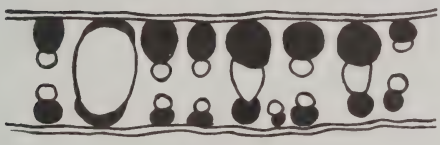

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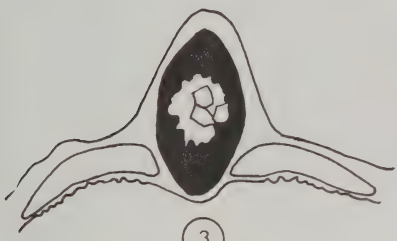

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Plate XI.

Fig. 1. *Cocos nucifera.* Midrib, X18.5. *Broadway s.n.* (F).
Fig. 2. *C. nucifera.* Lamina, X33. *Broadway s.n.* (F).
Fig. 3. *Rhyticocos amara.* Midrib, X33. *Hodge 2514* (GH).
Fig. 4. *R. amara.* Lamina, X42. *Hodge 2514* (GH).
Fig. 5. *Allagoptera campestris.* Midrib, X55. *Glassman 13070* (CHI).
Fig. 6. *A. campestris.* Lamina, X55. *Glassman 13070* (CHI).

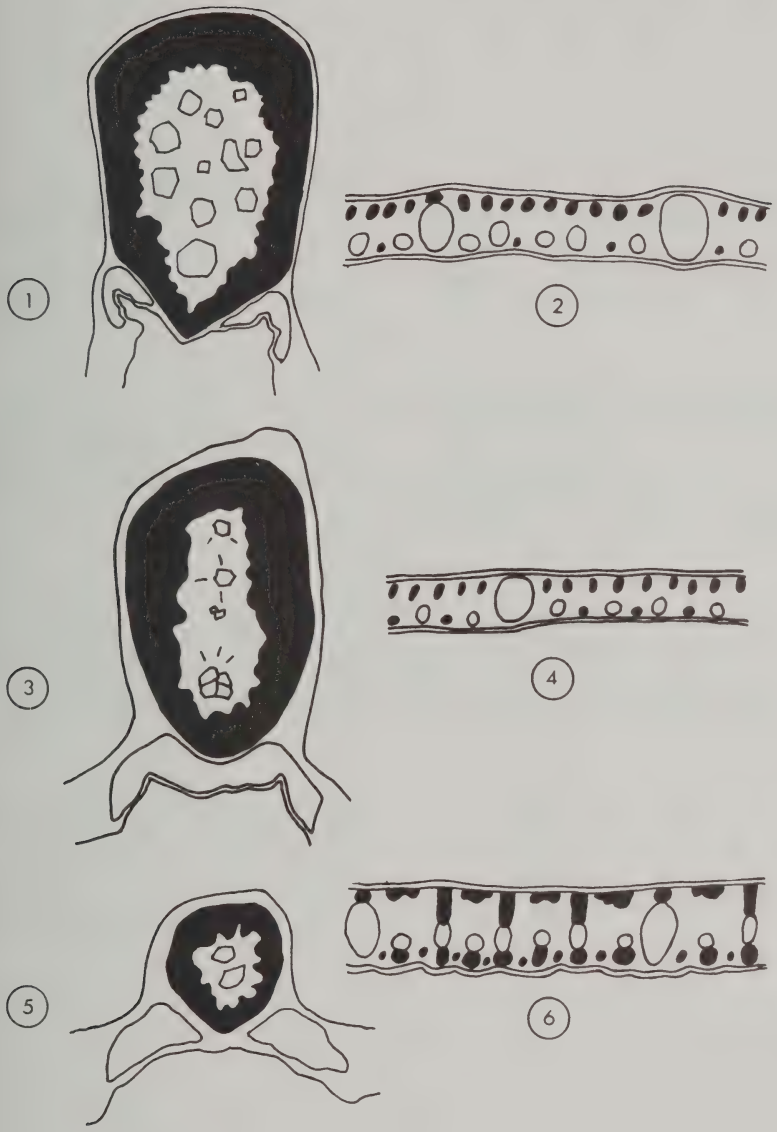
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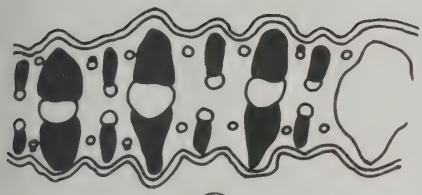
Plate XII. Species of *Butia* are not keyed out here, but are illustrated for comparison.

Fig. 1. *Butia yatay.* Lamina, X55. *Pedersen 4456* (GH).
Fig. 2. *B. paraguayensis.* Lamina, X33. *Pedersen 3030* (GH).
Fig. 3. *B. capitata.* Lamina, X55. *Glassman 8766* (CHI).
Fig. 4. *B. eriospatha.* Lamina, X55. *Glaziou 8059* (K).
Fig. 5. *B. arenicola.* Lamina, X55. *Hassler 3761* (G).
Fig. 6. *B. archeri.* Lamina, X55. *Glassman & Gomes 8023* (CHI).
Fig. 7. *B. microspadix.* Lamina, X42. *Hatschbach 11668* (F).
Fig. 8. *B. purpurascens.* Lamina, X55. *Glassman 13076* (CHI).



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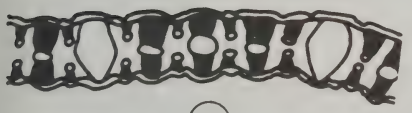

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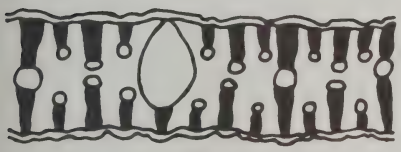

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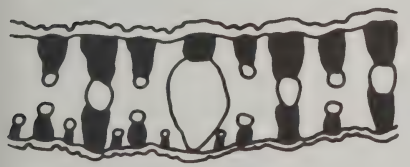

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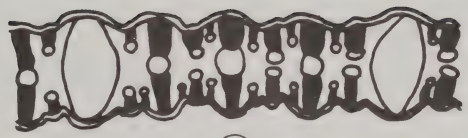

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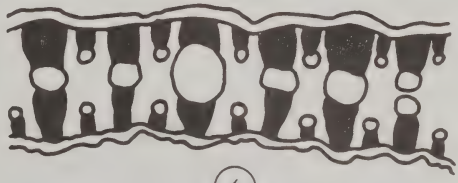

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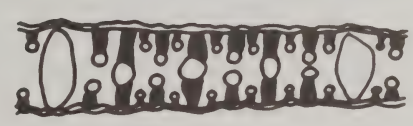

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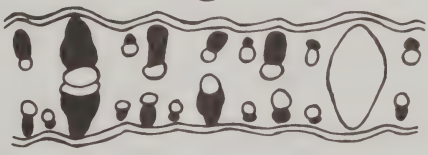

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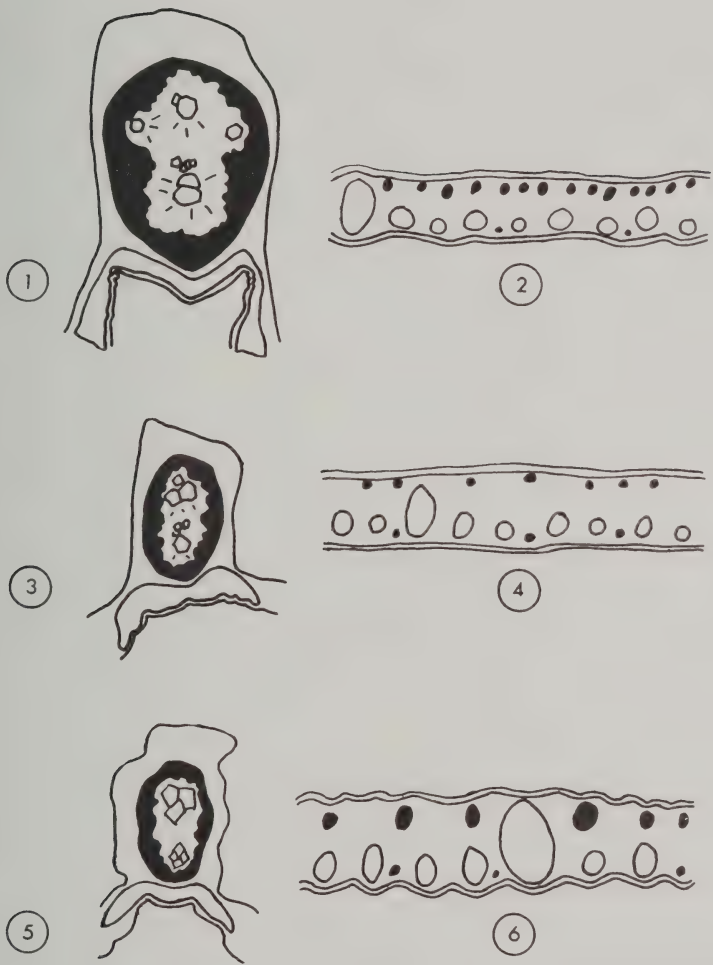
Plate XIII.

Fig. 1. *Syagrus botryophora.* Midrib, X55. *Bondar s.n.* (F-619734).
Fig. 2. *S. botryophora.* Lamina, X35. *Bondar s.n.* (F-619734).
Fig. 3. *S. cocoides.* Midrib, X55. *Dahlgren s.n.* (F-620809).
Fig. 4. *S. cocoides.* Lamina, X55. *Dahlgren s.n.* (F-620809).
Fig. 5. *S. getuliana.* Midrib, X55. *Bondar s.n.* (F-620823).
Fig. 6. *S. getuliana.* Lamina, X55. *Bondar s.n.* (F-620823).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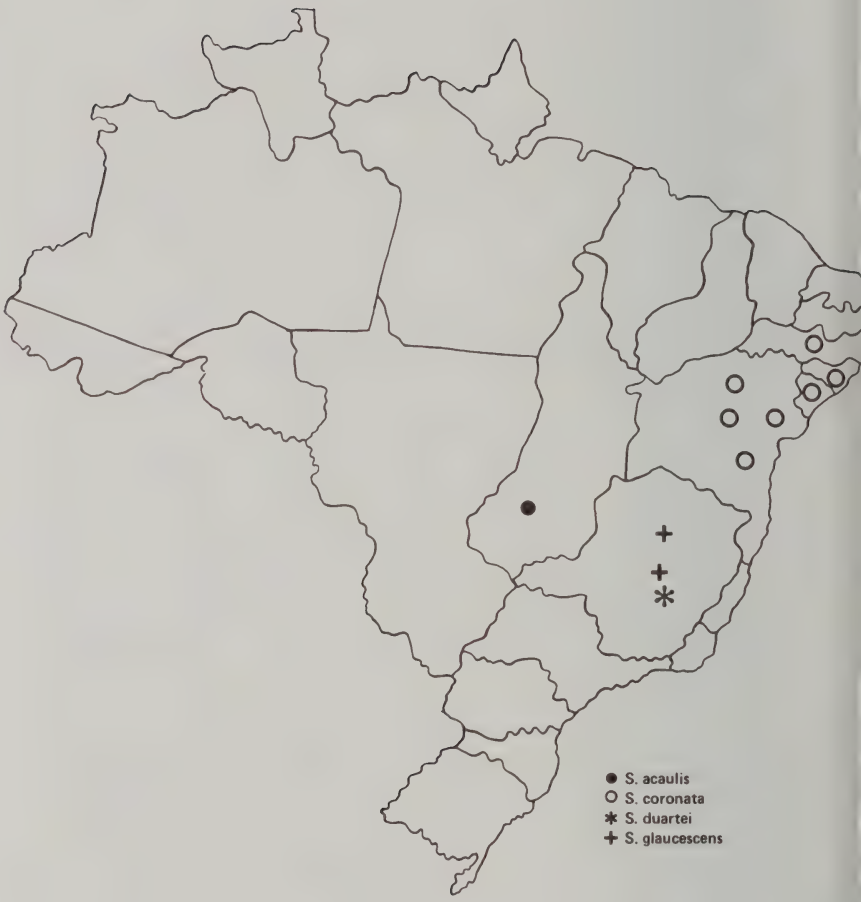
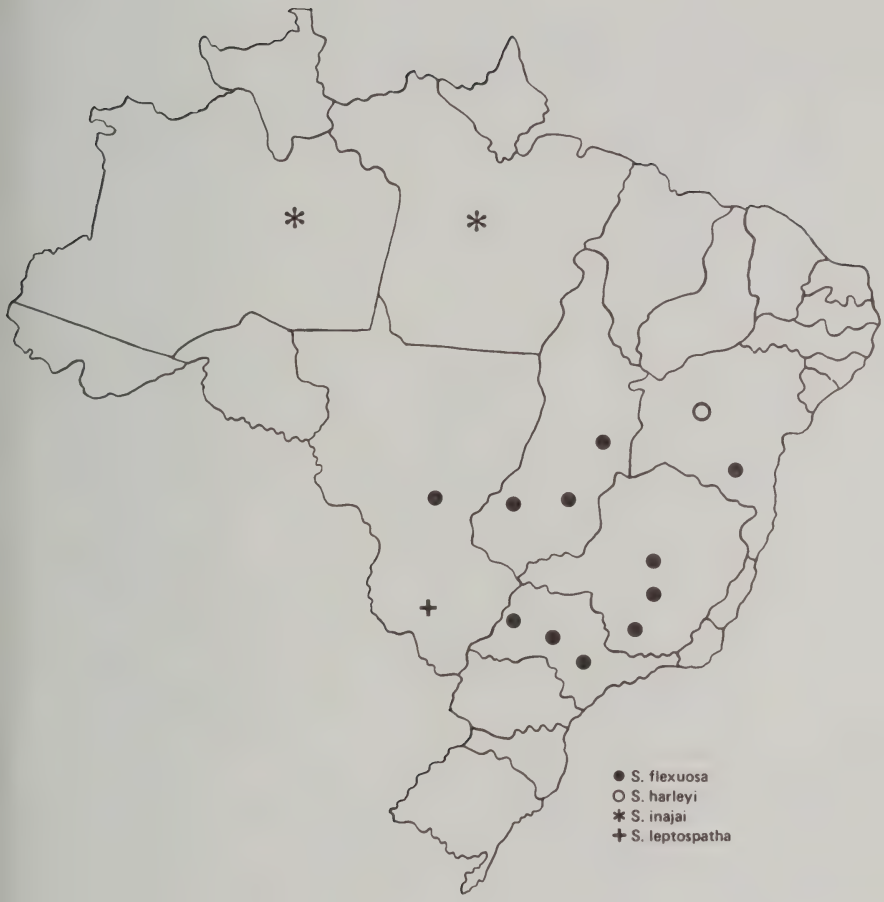
1. *S. oleracea, S. petraea, S. werdermannii*

2. *S. botryophora, S. comosa, S. macrocarpa, S. microphylla*



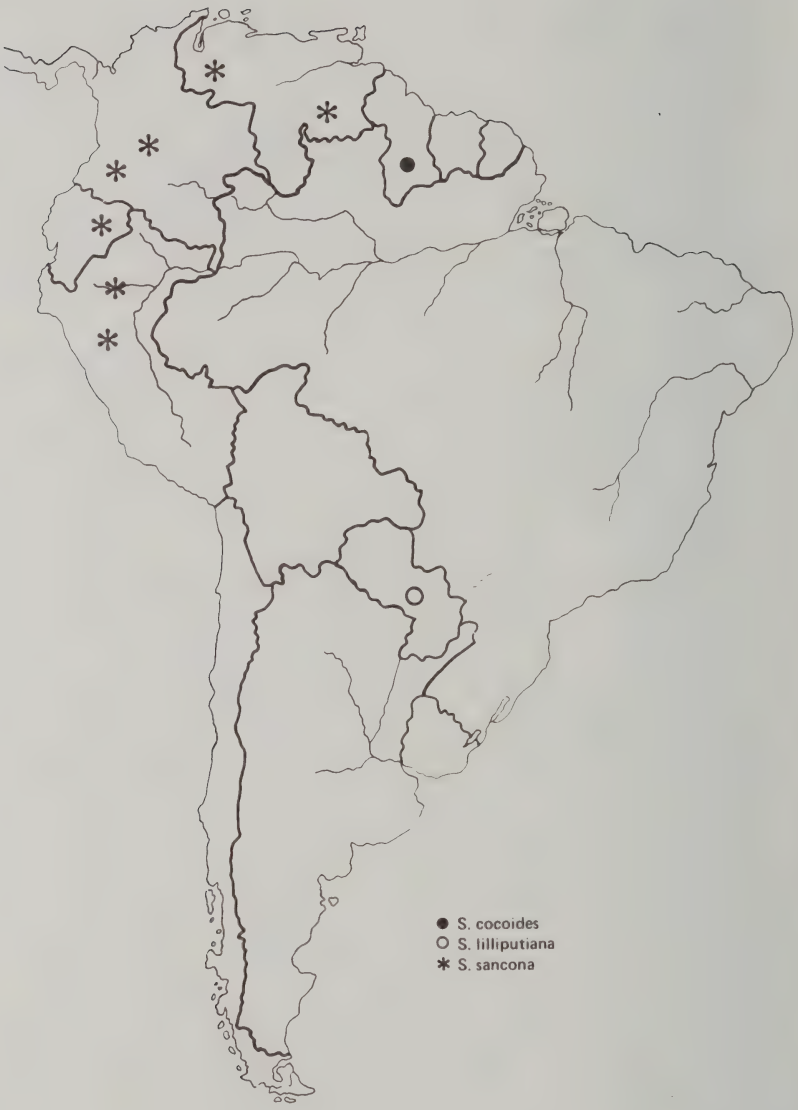
3. *S. acaulis, S. coronata, S. duartei, S. glaucescens*



4. *S. flexuosa, S. harleyi, S. inajai, S. leptospatha*

5. *S. campylospatha, S. orinocensis, S. petraea, S. stratincola*

6. *S. campicola, S. cardenasii, S. inajai, S. oleracea*



7. *S. cocoides, S. lilliputiana, S. sancona*

8. *S. ruschiana, S. pleioclada, S. vagans*

9. *S. cocoides, S. graminifolia, S. loefgrenii*

10. *A. romanzoffianum, L. hoehnei, A. schizophylla, M. weddellianum, M. insigne*

11. *A. romanzoffianum, C. smithii, J. chilensis*

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A Note on the Author

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